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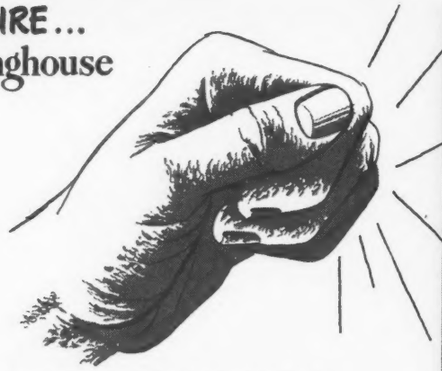

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Probably you think of Westinghouse as one of the world's largest manufacturing companies—which it is.

Yet Westinghouse is not just a single giant company. It is actually made up of many individual units. Each has its own sales, engineering and manufacturing organization. With such a divisional set-up, your progress toward a key job can be more rapid—advancement more frequent, your opportunities and scope of activities almost unlimited in any of the many divisions or subsidiary companies listed at the right.

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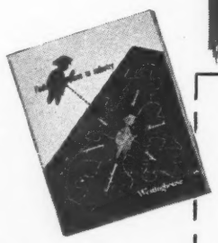
We invite you to investigate the opportunities open to you at Westinghouse. Begin planning your future today. Get your free copy of the booklet, "Finding Your Place in Industry".



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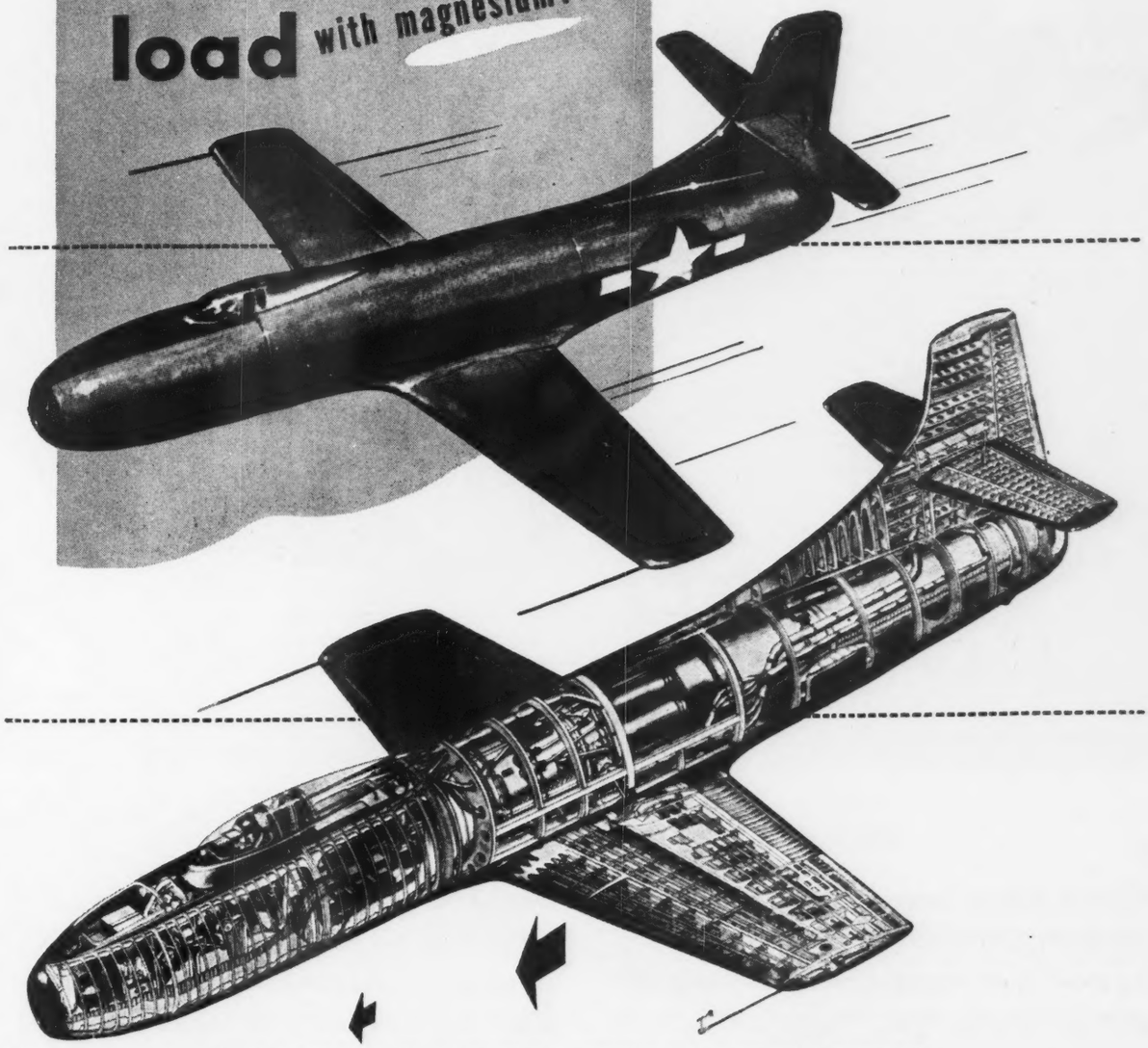
less "dead" load with magnesium...lightest of all structural metals



Here you see the Navy-Douglas D558 Skystreak—a dramatic demonstration of the structural advantage of magnesium. Strong magnesium alloy sheet is literally "wrapped" around the Skystreak's powerful jet engine to form the entire fuselage skin aft of the pilot seat. This makes possible a monocoque structure which completely eliminates the usual stringers, except for frames carrying concentrated loads.

However, this is only one use of magnesium. It is also used for binoculars, typewriters, pruning shears—in fact, wherever flexible design properties as well as lightness and strength are desired, magnesium should be considered.

Dow produces, in addition to magnesium and plastics, more than five hundred essential chemicals from plants strategically located in Michigan, Texas and California. Among these are pharmaceutical chemicals such as chloroform, iodine and aspirin; also insecticides like Dowklor and DDT, which aid greatly in increased agricultural production. Dowtherm, the liquid heat transfer medium for use in processing plants, is another of Dow's products, as is Methocel, which is used in many industries as a binder, thickener, and dispersing and emulsifying agent.

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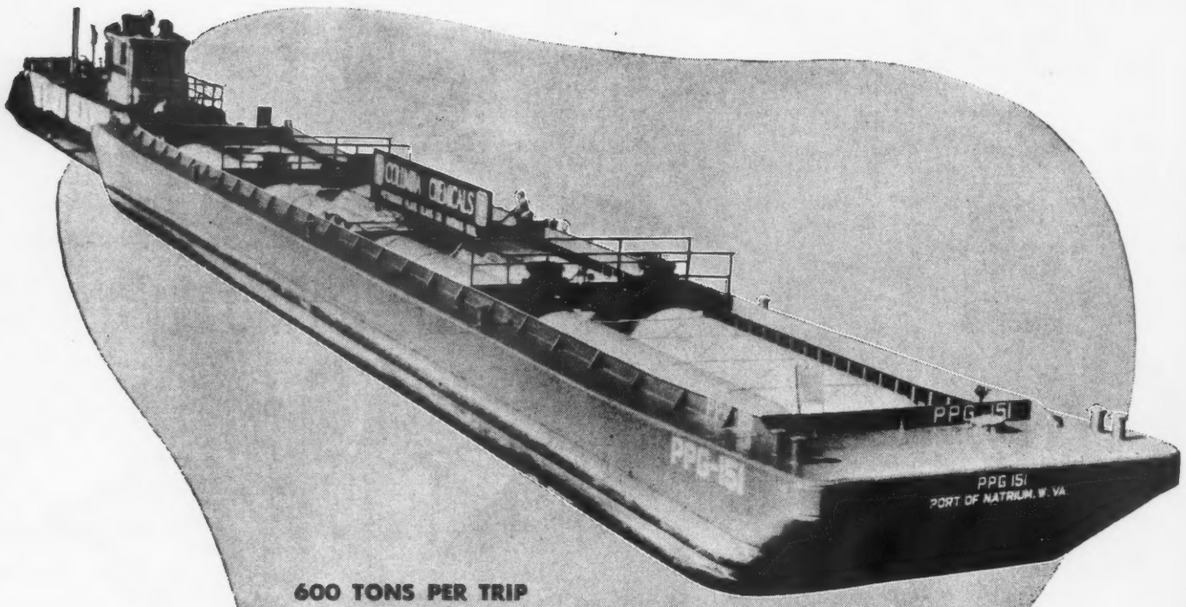
CHEMICALS INDISPENSABLE TO INDUSTRY AND AGRICULTURE

Record volumes of Chlorine shipped via waterways



600 TONS PER TRIP

Cradling four huge tanks in a 175-foot all-steel hull, each barge has a capacity of 600 tons of liquid chlorine. Many special features for handling and unloading are embodied in the design, which is based on a "pilot model" barge placed in service by Columbia several years ago.

Fleets of chlorine barges—the first ever designed specifically for this service—have been transporting record quantities of chlorine from Columbia's plant at Natrium, West Virginia . . . and from the plant of its affiliate, Southern Alkali Corporation, at Lake Charles, Louisiana. Operating along the Ohio-Mississippi inland waterways and the inland waterways system of the Gulf Coast, these chlorine barges provide obvious advantages to large-volume users of chlorine in these areas. They are among the most recent examples of the progressive service rendered by Columbia-Southern, the nation's largest merchant producers of chlorine. Pittsburgh Plate Glass Company, Columbia Chemical Division, Fifth Avenue at Bellefield, Pittsburgh 13, Pennsylvania.

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Examples? Better metals for giant turbines and generators, improved transformers and transmission lines. Stainless steel, resistant to rust and corrosion. Better plastics that make insulation fire-resistant, and more flexible and wearproof . . . for the millions of miles of wires it takes to make power our servant.

There is a promise, too, of even greater, more concentrated power. *Atomic* power harnessed for industry and the home . . . approaching man's dreams for the future through research and engineering. This also takes such materials as carbon . . . from which the all-important graphite, used to "control" the splitting atom, is made.

The people of Union Carbide produce materials that help science and industry improve the sources and uses of power . . . to help maintain American leadership in meeting the needs of mankind.

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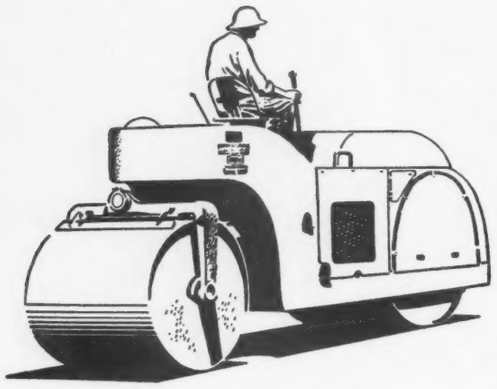
Another page for **YOUR BEARING NOTEBOOK**



How to keep a tandem roller from doing the shimmy

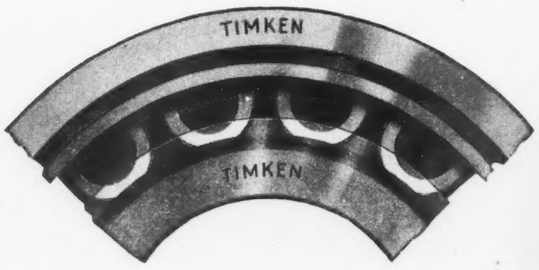
The king pin bearings on tandem road rollers like this take heavy thrust and radial loads. If wear and looseness develop, shimmy is the result. Here's another example of a difficult problem that engineers solve by using Timken tapered roller bearings.

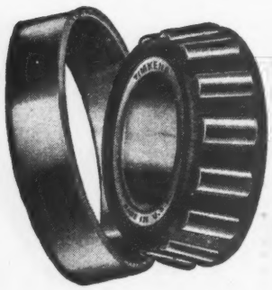
Timken bearings take both thrust and radial loads in any combination. Their true rolling motion means smooth, almost frictionless operation with negligible wear. Easy, accurate steering and freedom from shimmy are assured, even after years of hard service. The need for frequent lubrication is eliminated and maintenance is reduced to a minimum.

Here's why Timken® rollers stay in positive alignment

Accurate and constant roller alignment in Timken tapered roller bearings is assured by their design. Wide area contact between the roll ends and the rib of the cone keeps the rollers stable. It prevents skewing, eliminates the need for alignment by the cage, and increases load capacity.

The Timken Roller Bearing Company developed the principle of positive roller alignment—one more reason why Timken bearings are the number one choice of engineers everywhere.





TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

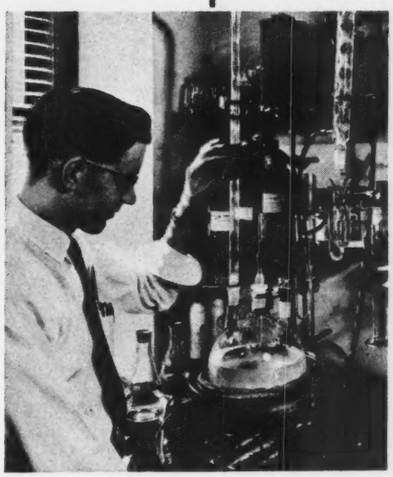
Want to know more about bearings?

Some of the important engineering problems you'll face after graduation will involve bearing applications. If you'd like to learn more about this phase of engineering, we'd be glad to help. For additional information about Timken bearings and how engineers use them, write today to The Timken Roller Bearing Company, Canton 6, Ohio. And don't forget to clip this page for future reference.

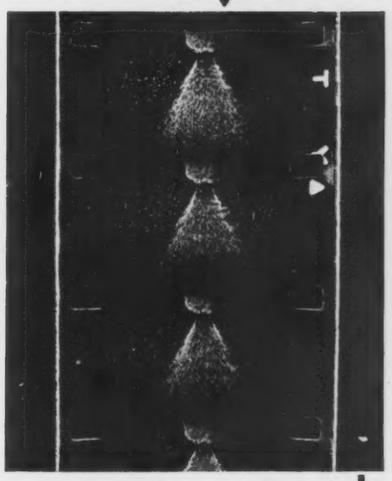
NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER BEARING TAKES RADIAL ◐ AND THRUST ⊣◐⊢ LOADS OR ANY COMBINATION ✳

"Flow Chart" of Procter & Gamble Teamwork

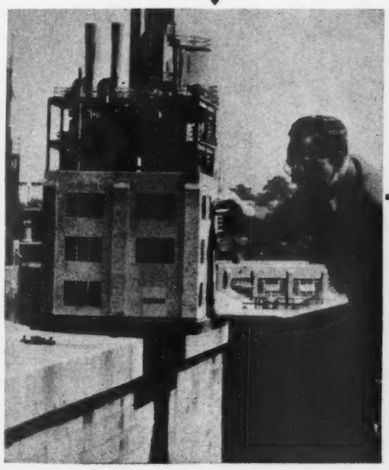
How the skills of many specialists develop a new synthetic detergent . . .



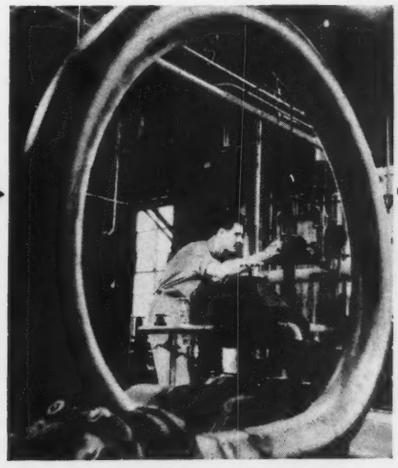
Chemists work in uncharted fields on reactions and formulae in Procter & Gamble's Research Laboratories.



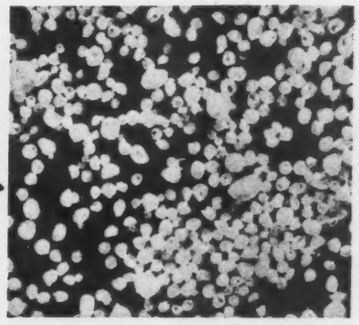
Chemical Engineers use high-speed motion picture photography to study proper nozzle design.



Mechanical Engineers study a 1/32 size model to help translate laboratory processes into reality.



Industrial Engineers face and solve interesting new problems when the finished plant goes into operation.



Result:
A new synthetic detergent

(magnified to show nature of hollow spherical particle)

This is just one example of P & G technical teamwork in action; similar developments progressing in other fields call for additional men with technical training. That's why P & G representatives periodically visit the country's top technical schools to interview students. If you would like to talk to a Procter & Gamble representative, ask your faculty adviser or placement bureau to arrange a meeting.

PROCTER & GAMBLE

CINCINNATI 1, OHIO

the tech engineering news

December 1948
Vol. XXX No. 2

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MEMBER OF THE ENGINEERING COLLEGE MAGAZINES ASSOCIATED

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from the editor's notebook

Last year, as a contributing staff member, **Ken Kopple**, '51, often "blew his stack" at those assigned to check up on him. This year, as a literary associate, he is trying his best to annoy prospective writers as little as possible. His contribution to this issue, an article on the photo offset printing process, which is as far from his field of interest in chemistry as he wants to get, is his fourth job for *T. E. N.*

Madge Rosenbaum, '51, is a mechanical engineer who also wants a degree in Civil Engineering. She did considerable literary work for high school publications but spent most of her spare time in semi-professional radio acting and is now a member of the Dramashop. As a Chicagoan, she naturally gravitated toward the I. I. T. surveying camp after having been cruelly rebuffed by M. I. T.'s Camp Technology.

After ten years in Greece, **George Scoledes**, '52, returned here to the country of his birth in 1939. He was captain of the track team, in which he won state honors, at A. B. Davis High, where he was also a member of the math, science, and discussion clubs. Before coming to Tech, he attended Syracuse University for a year. The mathematics and rocket research societies — as well as, of course, *T.E.N.* — are his major interests at the moment.

Ex-Seabee **Roy Jenkins**, '50, is well qualified to write about the "superistic" new Eastgate staff apartment house by virtue of his eight years construction experience as carpenter, piledriver, and rigger. Just last summer he was foreman on the new Mystic River Bridge job, while at the same time settling down to married life with his June bride. A graduate of Belmont High, Roy also spent a year at Chauncy Hall school after his two and a half years in the Navy. A varsity soccer player as well as makeup editor of *T.E.N.*, Roy has just received word of his election to Chi Epsilon, the honorary Civil Engineering society.

Art Editor **Charles Jordan**, '49, can be seen more often than not driving around in his 1948 Buick convertible, as befits the Chairman of the Society of Automotive Engineers. Last year $4,000 came his way from the prize-winning design he submitted in the General Motors auto body contest; designing cars for General Motors will be his occupation next year. Charlie is, in addition, a member of the senior cabinet of the TCA and President of the Combined Professional Societies.

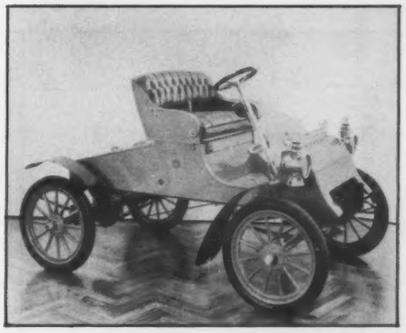
the evolution of the ford

A Picture Story of the Development of the Ford Car

By Charles M. Jordan, '49

The 1949 Ford is a far cry from its crude bicycle-wheeled ancestor which set Detroit talking in 1896. A series of models have come between the time of these two drastically different cars. The pictures here, which represent milestones in the evolution of the Ford, provide an interesting study in the development of the automobile. All pictures through the courtesy of the Ford Motor Company.

1901

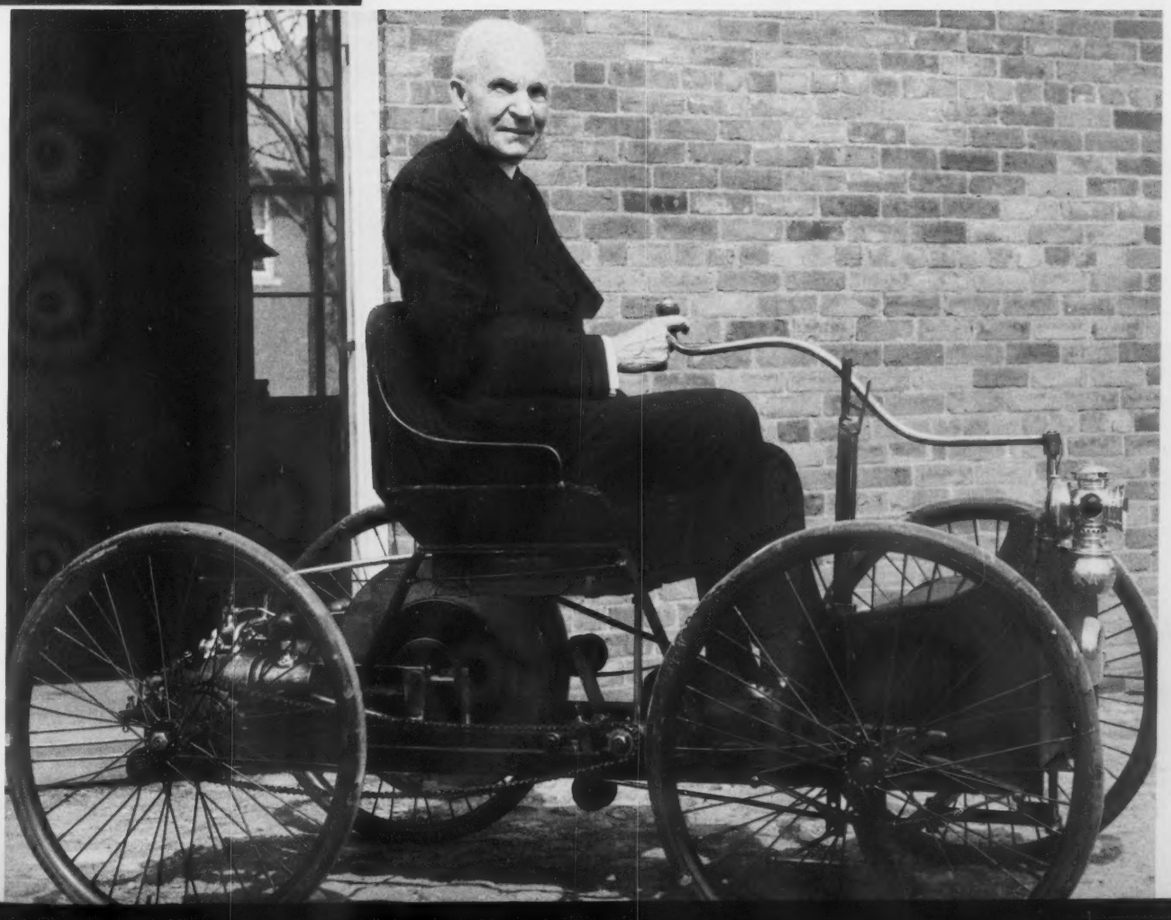


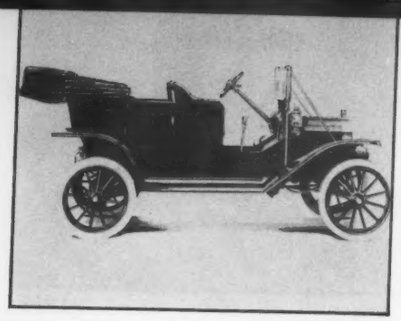
1903

1905

In a small brick shed on Bagley Avenue, Detroit, Henry Ford began his first car in 1893

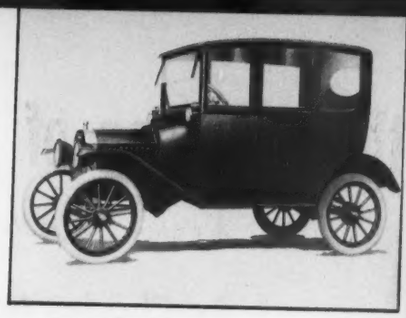
The first Ford was a crude vehicle mounted on four bicycle wheels, powered by a two cylinder gasoline engine.



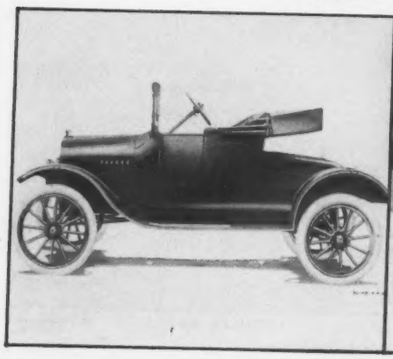


1908–09

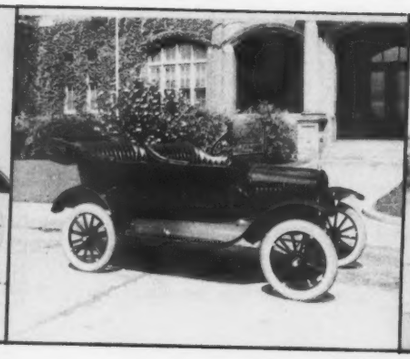
MODEL T



1916



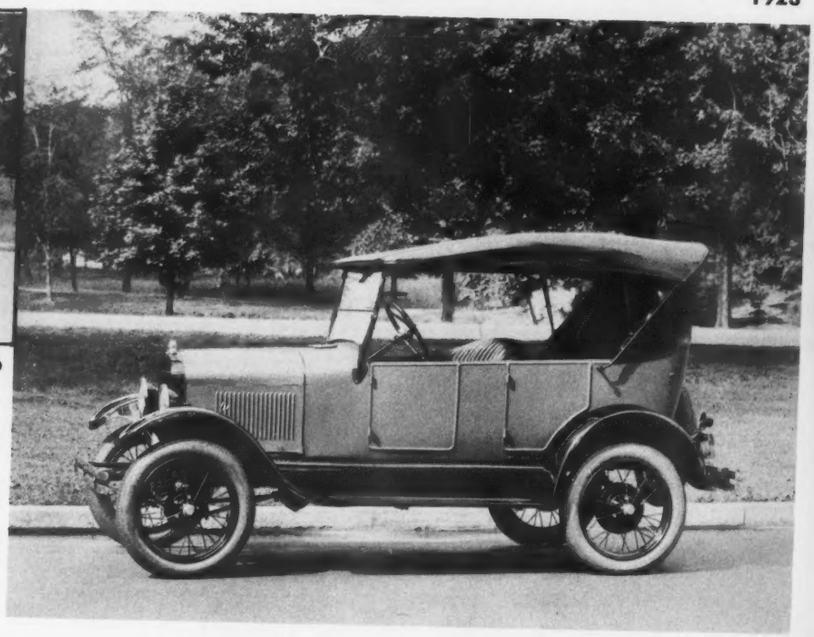
1920



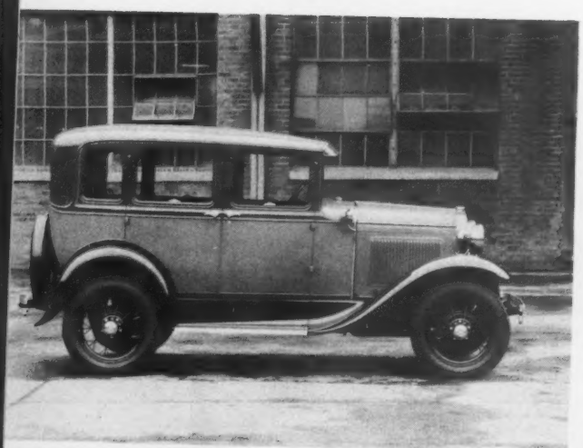
1922

1923

1926

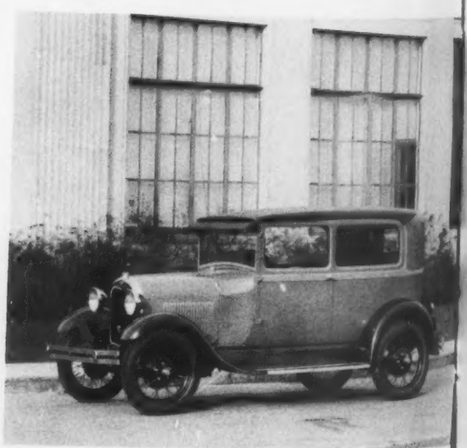


1927



1930

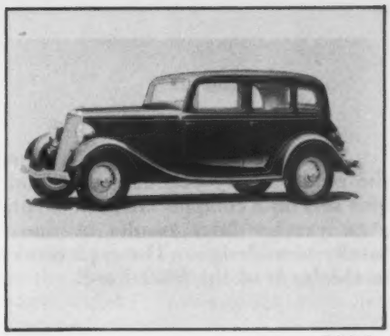
MODEL A



1928

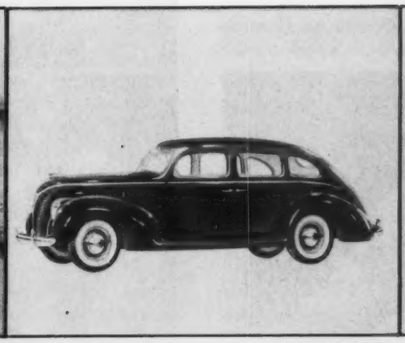
FORD V-8

1932

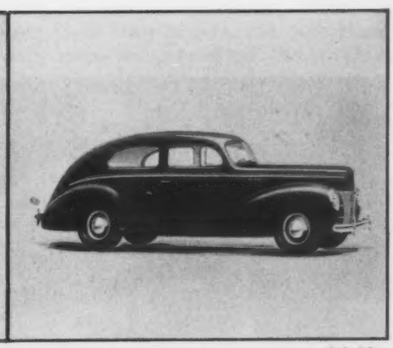


1934

1936



1938

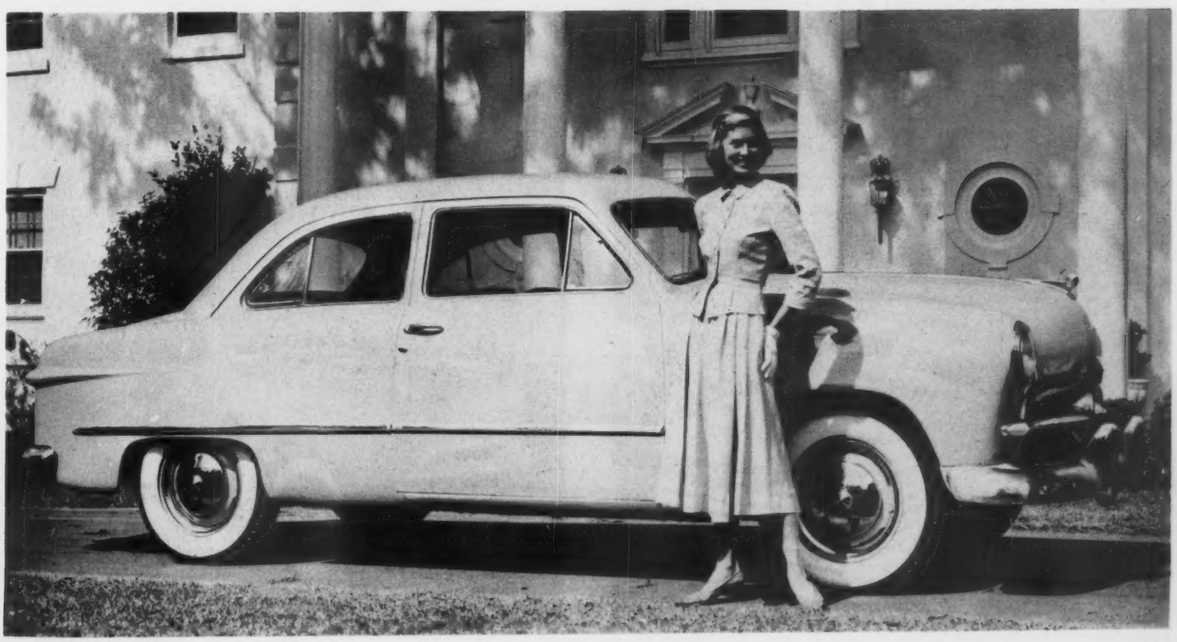


1940

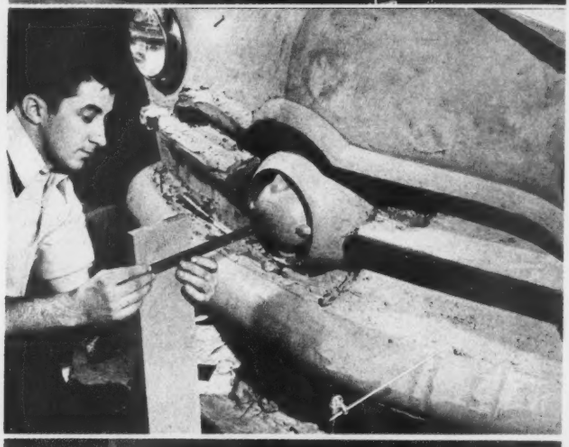
1941

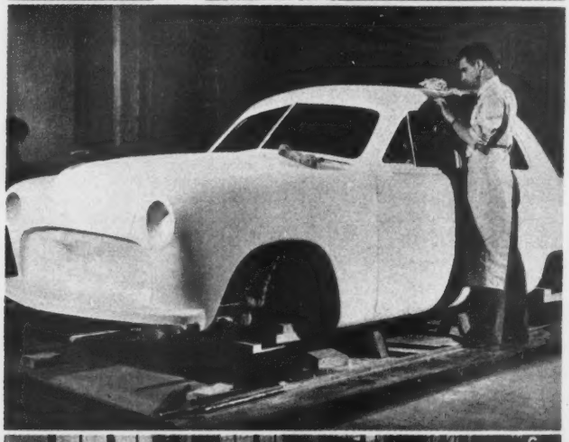
1947

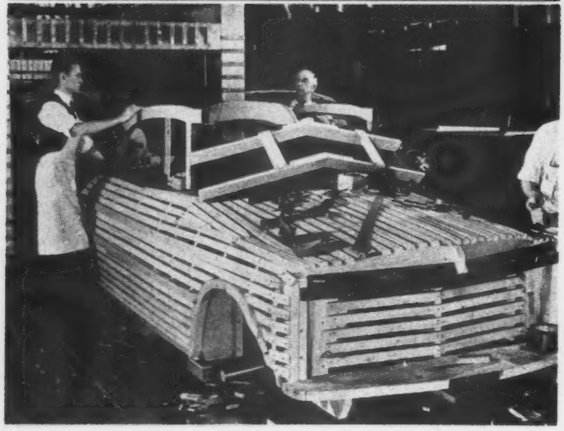
FORD 1949

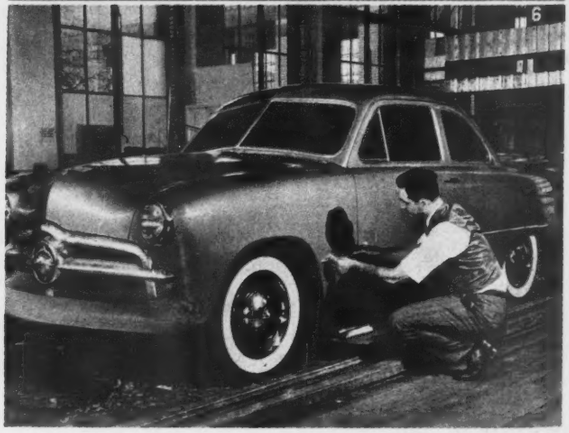


At the very beginning an automobile is an idea in the minds of stylists, designers, and engineers. That idea sets off a complex chain of events which months — even years — later results in mass production of a totally new design. These pictures show major steps in the birth of the 1949 Ford.









waging the peace—air phase

By George W. Scoledes, '52

The President's Air Co-ordinating Committee reported to Congress in 1945 that a minimum of 3,500 military aircraft a year is necessary for the assurance of peace. Yet, choosing to ignore this message, our national legislature is even now repeating the mistake which it originally made after World War I. As a result the air strength of the United States has dropped to the point where total production amounts to little more than one-third of this minimum estimate.

There is an essential point of departure from the former situation, however, in that this time delay might be fatal, for air power has now reached the point where it may well be called our strongest line of defense. To regain the thousands of skilled engineers and other specialists who, since the end of the war, have been lost to other industries, and to establish them in the accelerated program necessary for war, could very likely be an impossibility in the short time which we might have. This follows directly from the prediction of many military experts that the next conflict will be a "war of logistics and movements: swift long-range thrusts — all in the air!"

The long-range rocket guided from a distant ground base will very likely replace the bomber as a major military weapon in nine to sixteen years; however, a big, long-range, rocket program has not been begun. This is a costly mistake, for it will require at least three billion dollars and ten years to develop the weapon. Another development of modern aeronautics, applicable to peacetime uses as well as military purposes, is found in the jet aircraft. With such a type plane, the United States recently set the world subsonic speed record and became the first nation to develop aircraft capable of supersonic flight. Not enough such jets are being built, however.

Peacetime means that the aircraft industries must keep active by filling commercial contracts. However, as well as cancelling their own orders, the Army and Navy have in some measure prevented the airplane companies from obtaining commercial contracts — by putting on the market a great number of their surplus transports. In addition, the postwar flying craze never did jell as expected.

All of this means that the profits accumulated during the war years are now rapidly disappearing, that many companies are being forced to borrow heavily, and that huge numbers of important people are being forced to find jobs in other industries. As an example of the last fact, latest figures indicate that employment has dropped from a wartime peak of 2,105,000 to 150,000.

On the West Coast, where more than one-half of the nation's aircraft industry is situated, the four major aircraft industries have lost $20,000,000. One important reason for this inability to keep in the black is the presence of six large companies in a market that any one of them could fill easily with a year's production, not taking into account competing foreign companies.

The process of putting across a new plane is no easy job. For one thing, it costs twenty to thirty million dollars to research, engineer, and build a desirable new transport; secondly, when it reaches what market exists,

(*Continued on page 68*)

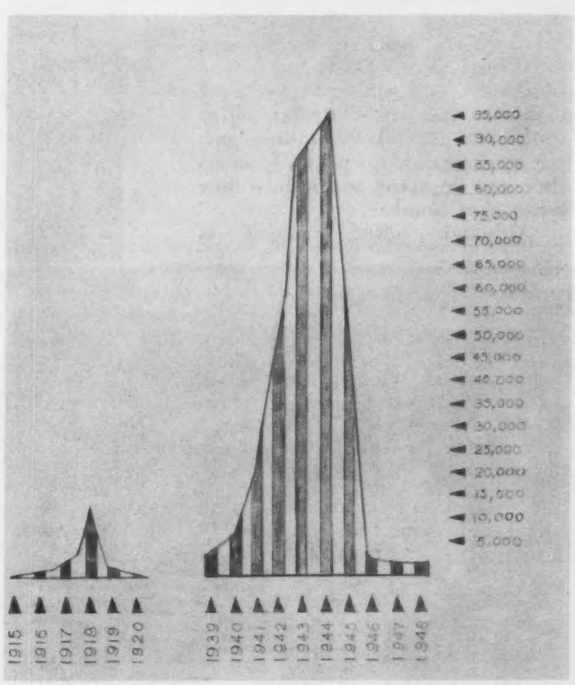


Figure 1. A graph of the United States production of warplanes and multi-engined civil transports through two wars. In 1944, 96,369 aircraft were produced, the greatest amount ever to be produced by a single nation in one year. The total cost of production in 1944 was $19,400,000,000, including parts and excluding the value of engines.

double flip-flop

By Kenneth Kopple, '51

Photo-Offset Faster and Cheaper When You Use Many Pictures

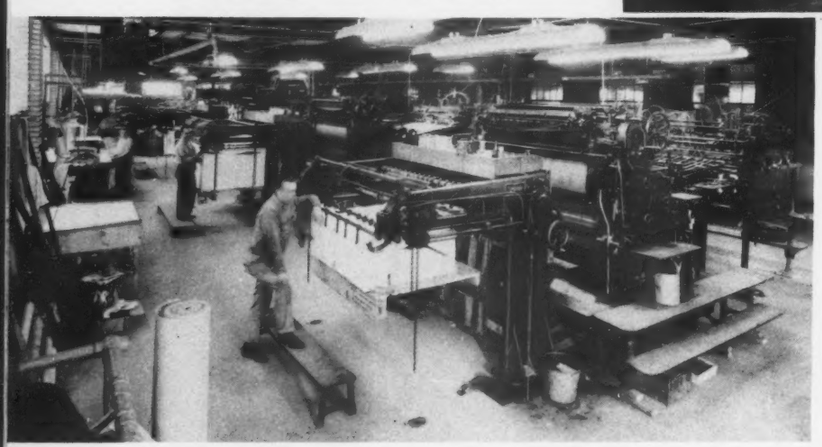
Almost anyone contemplating publication of an average job today is faced with a choice between two printing processes — the familiar letterpress and the newer photo-offset. Since such familiar publications around Tech as *VooDoo* and the TECH ENGINEERING NEWS are handled by photo-lithography, as the second process is more correctly called, a description of the process may be of interest.

Photo-lithography is a modern improvement on the older graphic art known as lithography. Invented in Bavaria at the close of the eighteenth century, the lithographic process is based on the transfer of an original design from an inked stone slab to paper, metal, or what-have-you. Placed on the stone directly, by means of oil-base crayons, the design is "fixed" there by means of an etching solution of nitric acid and gum arabic. The stone, moistened with water, is treated with a resinous ink, which, due to its hydrophobic nature, adheres only to the portions of the stone carrying the pattern. The high degree of skill required to place the original design directly on the plate, however, makes the process financially impractical in most cases.

The modern combination of photographic and lithographic processes dates back about sixty years, but the modern process with which we are concerned was developed about half as long ago with the introduction of the zinc or aluminum plate onto which the material to be printed is transferred photographically. The terminology, photo-offset, indicates the fact that the image is not transferred directly from the metal plate to its final resting place, but is first transferred to a rubber blanket and thence to the paper. Offset plates last for about 50,000 impressions, but by a special "deep etch" process they can be made to produce four times that number.

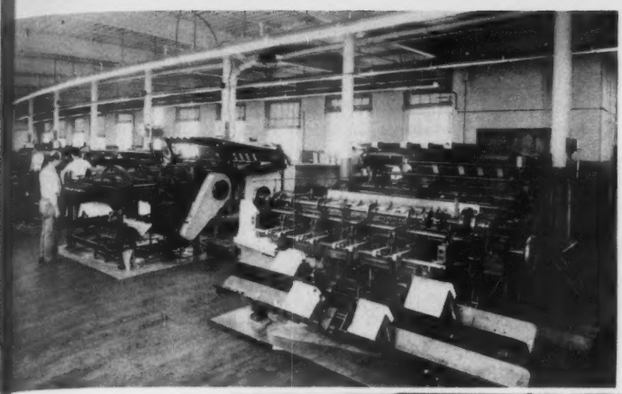
Although offset printing is primarily a means of making numerous copies of an original already in existence, and as such is much used for reprint work, the process boasts a long string of other good points. In publishing material containing photographs or other continuous tone originals, where the cost of making zinc or copper half-tone cuts is always a major factor, the use of photo-lithography introduces a large saving, since the use of these cuts is obviated. In four-color work, which is the usual form of color printing today, the expense is cut even more, since four separate cuts would normally be necessary; consequently, photo-offset is much used in color work today. Because of the photographic nature of the process, it is not necessary to submit copy of the same dimensions as the desired reproduction, since images can be enlarged or reduced before transfer to the zinc plate.

The rotary offset presses used in photo-lithography run more rapidly than letterpress machines, and to this time gain is added an even greater one caused by the partial elimination of pressroom make-ready. When type and other material are to be set up in a press, prior to running off the finished product, an elaborate adjustment is necessary in order that ink density on



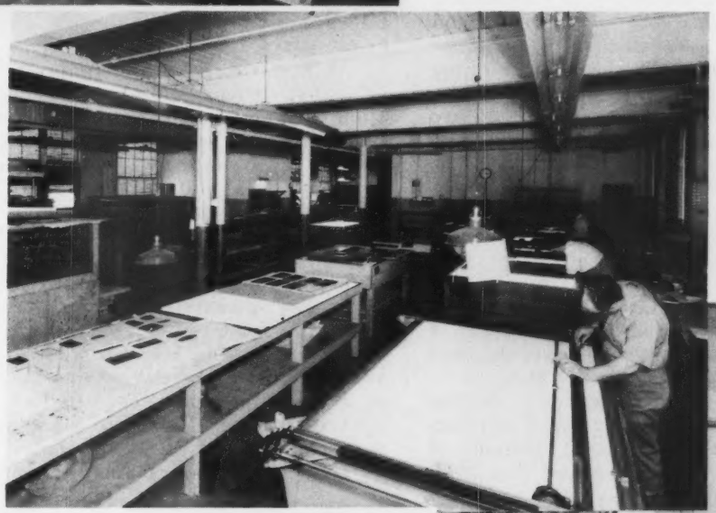
These typewriter-like machines transfer and space the copy on perforated rolls. When these rolls are placed in type-setting machines the process of type setting becomes automatic.

A battery of modern rotary offset presses, the largest of which turn out a printed sheet 44 by 66 inches. All pictures taken at The Murray Printing Company of Wakefield.



The completeness of mechanization in a modern printing plant here evidenced by these cutting is, folding, and binding machines

Modern mechanization speeds up the layout process



After "graining" and prior to exposure, the zinc plate is coated in a whirler with a light-sensitive emulsion

the finished product be correct and that design components be in their proper positions relative to boundaries of the page. With photo-lithography, much, if not all, of this work is eliminated — the positioning adjustments being made when the zinc plate is prepared; and the ink density problem being simplified owing to the fact that there is only one component at a time which carries the ink.

One more plug for the process and we will go on. In some cases, by far the greatest asset to photo-offset is its versatility. Almost any type of paper, or stock, may be used with the process and almost any type of format may be reproduced without undue difficulty.

The emphasis on photo-lithography as a copying process may lead one to wonder how a book containing new printed material and pictures may be produced. The answer is quite simple: type is set up as in standard practice on linotype or monotype machines and the proofs photographically transferred to the zinc plate; picture material is separately photographed and transferred to the plate at the same time as the type images.

Let us now trace the publication of a new work through a modern photo-offset plant, from copy and photographs to finished product.

Printed material, either typewritten, written, "Varityped" copy, or proofs of type set from copy, is photographed on a high contrast negative material and developed for high contrast. Owing to the nature of the photographic emulsion, certain limits are set on the colors of paper and written material since certain combinations of colors will markedly reduce contrast on the non-color sensitive film used. For example, black copy on blue-white paper produces high contrast, while light red or green on white will give poor results.

Line material, such as graphs or cartoons, is handled in the same manner as printed copy, but continuous tone originals such as photographs must be handled by a halftone process. This type of copy is photographed through a finely ruled screen which breaks up the image into dark and light point areas, just as in the ordinary newspaper photo. Although the contrast between dots is necessarily high, the overall effect, when viewed from a normal distance, is that of a continuous tonal gradation. This halftone process is necessary since a continuous variation of ink density cannot be produced by either offset or letterpress methods.

When the negatives are ready for further processing, they are "stripped," or trimmed, inspected and imposed out on a layout sheet, their corners fastened down. It is in this layout work that much of the make-ready involved in letterpress is taken care of. The layouts then pass to the opaquing department where negative

(*Continued on page 84*)

women in the sticks

By Madge Rosenbaum, '51

EDITOR'S NOTE

We have always wondered if any coeds go to surveying camp at Tech. Evidently they do not, but here we have the story of a Tech coed who went to a similar camp. Her adjustment to the slightly less than unanimously male population, and its adjustment to her is a narrative which may be of interest to the Tech man.

Two of the sophomore courses in Civil Engineering at Tech are "Advanced Surveying" and "Route and Construction Survey." The customary prerequisite for these subjects is the field work in them, taken during the summer at M. I. T.'s surveying camp in Maine. But when, as a budding C. E., I went to see Dean Pitre to make arrangements about attending, he referred me with smiles to Professors Shea and Gifford of the C. E. Department. The professors smiled at me in turn. I was told that Camp Technology had absolutely no facilities for women students, that it was deep in the woods, miles from the nearest town, and further, that there would be night work such as star-shooting. At this point they grinned at me and suggested that I take a photogrammetry course on the campus instead. I then suggested attending surveying camp at some other school. They acceded, and I was on my own.

It occurred to me that, as a Chicago girl, the one surveying camp I might possibly talk myself into was Illinois Institute of Technology's Camp Armour. I learned that an I. I. T. coed was scheduled to attend. I wrote a letter to I. I. T. pleading my cause and mentioning that their coed might like company. I was promptly refused. After some time and outside help I got the decision reversed and was on my way.

Early June found me at Illinois Tech, registering and shaking hands with Shirley Schultz, the coed with whom I was to "keep company." We got friendly at once, and arranged then and there to make the trip to camp together. When Shirley gave me the inside information of the camp, I was not pleasantly surprised to hear that I. I. T. requires the classroom course in surveying before the summer camp.

Well, I got hold of the textbook and waded through most of it. However, not having the actual instruments for surveying in front of me, I had considerable trouble in learning their use.

When the time came, Shirley and I took the long train trip to Minocqua, Wisconsin, the nearest stop to the surveying camp. Since we were the first coeds to attend Camp Armour in its forty-year history, we were looking forward to our reception. Disembarking in the evening we found that the camp had forgotten all about us. A wild twenty-five-mile taxi drive over the worst roads imaginable finally brought us to the camp lodge where we were swamped by a rugged, ragged and unshaven crew of surveyors who shook us by the hand, and admired our high heels and "new look" — they wore dungarees and lumber shirts.

After doing odd jobs for the first few days in order to straighten out the camp, we finally got down to the business of surveying. Taping, one of the simplest jobs in surveying, marked my not-so-simple initiation as a civil engineer.

Early one morning we were given maps of the surrounding territory, including the polygons we were to tape (measure directly by tape according to horizontal length), and were assigned to field parties. Having collected my share of equipment and joined the boys in my party, off I went.

At first the fellows were pretty reserved in my company, though polite and helpful. Although they knew each other well, they did not know how a woman surveyor would act and were playing it safe. Consequently the atmosphere was frigid and it was up to me to change it. I did my best.

It finally dawned on them that I would not cry if I were scratched by the heavy underbrush; would not faint if they cursed; was willing to do my full share of the work; and could exert the twenty to thirty pounds of tension necessary to stretch tape. I acted in a completely matter-of-fact manner; exchanged anecdotes about school and "told them off" when the occasion arose. By the second day we were buddies and remained so until the end of camp. In fact, all the fellows I worked with came to regard me as just another C. E. and that was just what I wanted.

Having mastered taping, we were re-formed into parties of two in order to take up leveling. During this phase of our training I caused considerable amuse-

"There was nothing formal about camp attire."

ment by swaggering about with the fifteen-pound level over one shoulder in the proper style. The level remained my favorite instrument throughout summer camp, but my real triumph came with the transit.

A transit weighs about twenty-five pounds and I had been warned that I would have to let the fellows carry it for me or suffer some injury. Of course, I was not expected to come up to their muscular standards, but on the other hand it would be a real hardship for them to have to carry my share of the work. When I offered to carry the transit in turn I received a flat negative answer and was forced to harangue the poor fellows until in sheer self-defense they were forced to hand it over.

Toward the end of the day I came jauntily into camp carrying the transit over one shoulder, with two boys carrying range poles as a guard of honor and a fourth ostentatiously holding a plumb bob. The reaction to my entrance was varied. Some laughed, others stopped dead in their tracks and one instructor came dashing forth and cursed the fellows backwards and forwards. Those who had warned me against carrying the transit were partially right. My shoulders were bruised masses of jelly until they got used to that harsh treatment.

All sorts of things seemed to happen during camp. A series of forest fires in Wisconsin brought the rangers around camp in order to recruit fellows as fire fighters. I had always wanted to be a fireman and this was my chance. I grabbed a sweatshirt and dashed out to join the others, running directly into the professor in charge of camp, who refused to let me go.

Ten minutes later I caught up with the fellows at the ranger station, who did not like the idea of my staying behind any more than I did, and schemed to get me on the truck which would take us to the fire. Borrowing a big hat, I pulled my hair up into it but refused to take my lipstick off. When I signed up for the payroll, the ranger in charge just stared at me while he proceeded to misspell my name.

At the fire I grabbed a shovel, as did half of the fellows. The others shouldered five-gallon water cans. Our particular conflagration was a smouldering swamp fire, at which those who had shovels turned over the soil and those with water cans did just what one does with water cans at a fire. Working on and off, we all became quite friendly. About this time I was accepted into the regular "bull sessions."

When a second set of fires drew boys from camp once more, I remained behind to help with some wrecking and carpentering around camp. I was doing so well that I stepped on a rusty nail and drove it into my foot. I gave one yell and half the camp came running; before they were through there were three different kinds of antiseptic on my foot. Told to go off and rest, I went to get some water to drink, as did some of the others. During the course of the ensuing conversation I was sprinkled with the water. I sloshed some water on the guys; they sloshed some water on me. I got a dipper; they got a bucket. Once I was doused it was decided that I should make a day of it. I had barely time to take off my sun glasses before I was seized bodily, dragged to the lake, and heaved in, one-two-three-splash. The entire camp, instructors included, stood by and cheered. Acting insulted, I waded out, made a speech, and turned back for a short swim, clothes and all.

Shirley, the other coed at camp, never had the honor of being thrown into the lake but had her share of those happenings that later make amusing stories. She decided to trim her hair, and, as there were no beauty shops in the vicinity, one of the fellows officiated. The end result can be imagined — Shirley was forced to go to the nearest barber and have as much as possible of the damage repaired. To top it off, Illinois Tech's publicity department decided to take pictures of us that day.

There being no plumbing at the camp, the lake served as a bath tub as well as a swimming pool. When Shirley and I wanted to go swimming, we gave plenty of advance warning and were preceded by cries of "condition red."

"The level remained my favorite instrument throughout camp."

In general, Shirley and I succeeded in destroying a lot of their ideas about women's behavior. I will never forget one Sunday morning when a dead mouse was dangled in my face. Interested, I examined it closely and my tormentor walked away, a broken man. Thereafter he confined his efforts to remarking "Those are fattening," whenever Shirley and I took our second and third helpings of potatoes. Soon he even gave that up and began making remarks about "chowhounds" who grab the food from before a man's face if he does not defend it.

There are many stories I could tell of my experiences during fieldwork — the time we got two miles from camp with a transit and no plumb bob; the time we got caught in the rain twice the same day; the time we pruned a tree almost to a stump and found we had to make a new set-up anyway; the many bull sessions.

Outside of field work, one of the things I liked best was the fact that we could "go out" with the fellows without dating. After K. P. work was over, there was sure to be somebody with a car to start for town and Shirley and I would join them. When we arrived in town, we usually paid our own way, which I prefer to do. If we danced, we danced with everyone; and we were as free to ask the guys to dance as they were to ask us.

The fellows were always eager to show us off as "women surveyors" or "woman C. E.'s" even when they would argue with us about women in professions. All in all, I learned quite a bit at surveying camp, and had a fine time at it.

eastgate

By Roy W. Jenkins, '50

Twelve-Story Modern Apartment House for M. I. T. Staff Now in the Planning Stage

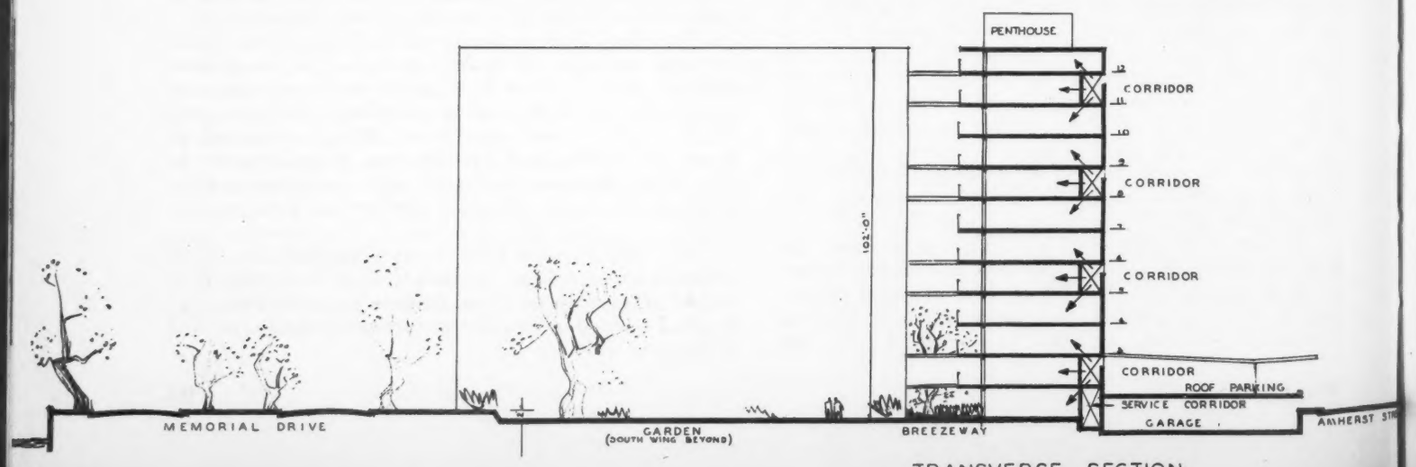
On November 15, 1948, President James R. Killian, Jr. of the Massachusetts Institute of Technology announced that plans are being drawn for a twelve-story apartment building on Memorial Drive between the President's House and the National Research Building.

The land is owned by M. I. T., but it will be leased to the New England Mutual Life Insurance Company which will build and operate the apartment house. Since the project is the company's first venture into the housing field, the officers and directors are particularly concerned that it should not only be an outstanding example of modern, functional architecture, but also that, as such, it should be a distinct contribution to the housing development of the Boston area.

The architects who were assigned the formidable task of designing apartments which would be in advance of current practice are all members of the staff at M. I. T.'s School of Architecture. Working under the general direction of Dean William W. Wurster, and associated with Thomas Worcester, Inc., have been William H. Brown, Robert W. Kennedy, and Carl Koch, with Vernon Demars and Ralph Rapson as consultants.

Working for over a year on extensive preliminary studies, the designing team first set up a series of general objectives or requirements for investment housing. Looking ahead to a competitive period, their analysis brought forth certain standards of service which will eventually set the tone of tomorrow's housing.

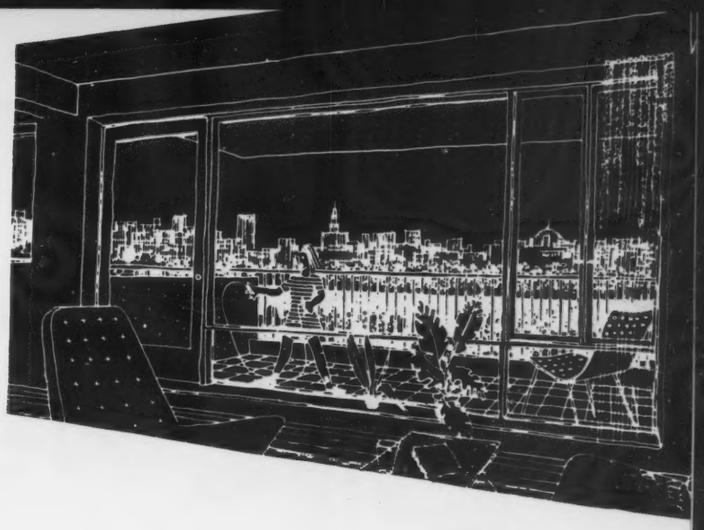
Sun, view, privacy, and ventilation: these four represent what might be called the cardinal necessities of all modern apartments. The correct orientation of a building will result in a maximum amount of sunlight in each and every apartment. View is not only a matter of location, but also a matter of exposure of each unit to what may be the only exciting or interesting panorama available. Privacy is best obtained by eliminating proximity to neighboring structures and by planning a building that will not be a series of wings separated

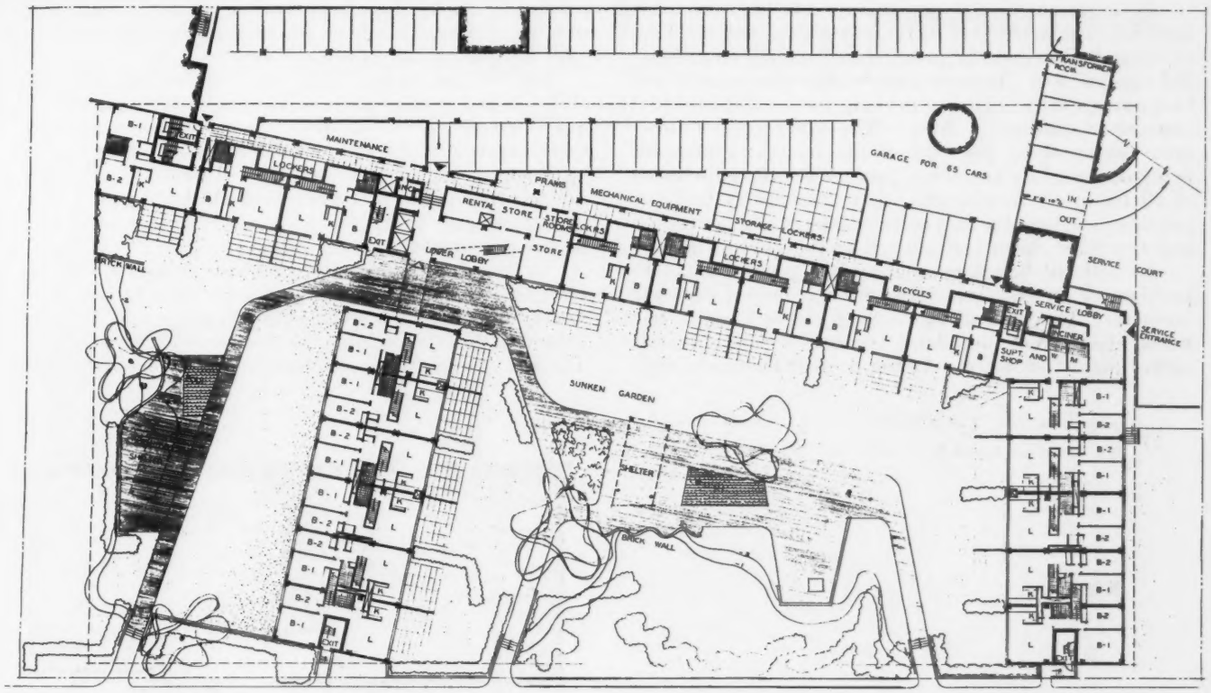


TRANSVERSE SECTION

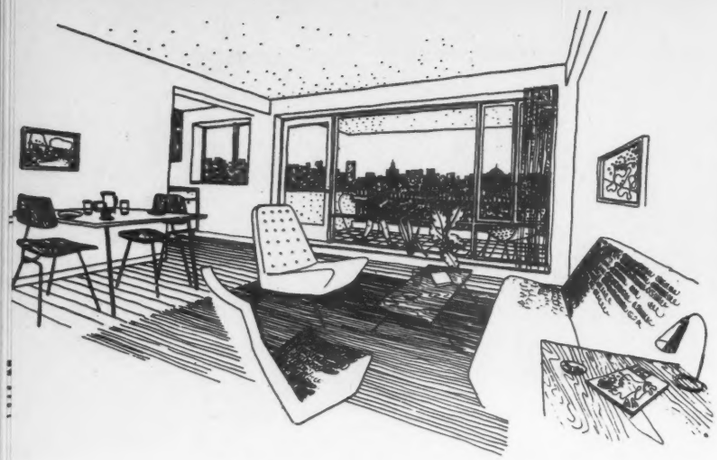
only by a narrow court. Adequate ventilation may be obtained by consideration of the prevailing winds and also by provision for through air currents in every apartment.

From the very beginning, Eastgate was planned primarily for Massachusetts Institute of Technology personnel. A study was made therefore of the family composition, income, rent scale, and housing standards of the staff. The conclusions reached were that a considerable number of the staff would be attracted to the apartments at the projected rentals; the proportion of small, medium, and large families was the same as that of similar income groups throughout the country; the unit distribution could therefore be very close to the average of recently built apartment houses. As a guide in planning, the following distribution of space was adopted: studio or no-bedroom apartments would occupy from two to ten per cent of the available space; one-bedroom apartments, forty to fifty per cent; two-bedroom apartments, forty to fifty per cent, and three-bedroom apartments, two to ten per cent.

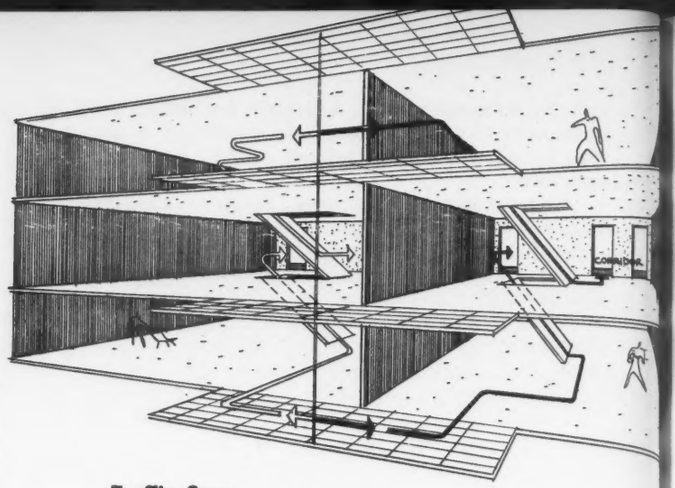




Plan at garden level
Notice community facilities



View



Traffic flow

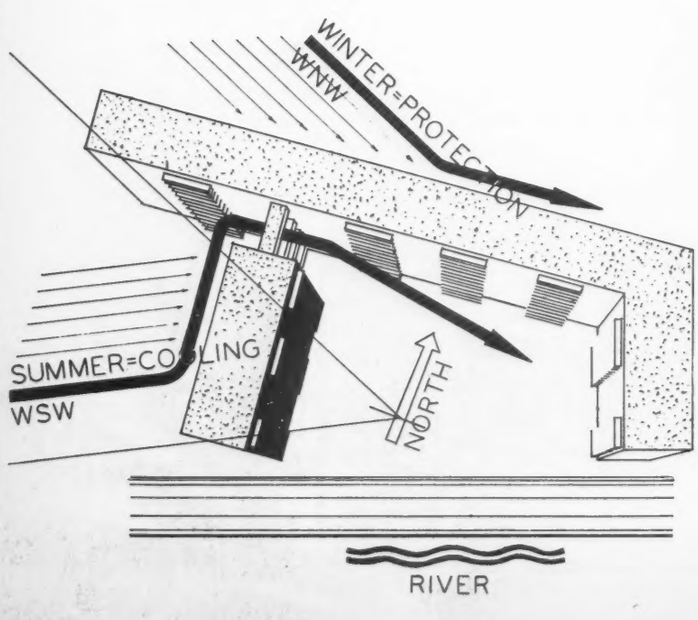
As a result of the preliminary studies and cost analyses, the architects have proposed a twelve-story elevator building of fireproof construction, containing 261 apartments. Incorporated within the project will be a garage with sixty-five parking spaces and an equal amount of outdoor parking. The building will cover only twenty-three per cent of the lot, the remainder being occupied by two large gardens for the enjoyment of all tenants. Among the other community facilities provided are laundry and social rooms in the penthouse and space for shops and storage in the ground floor.

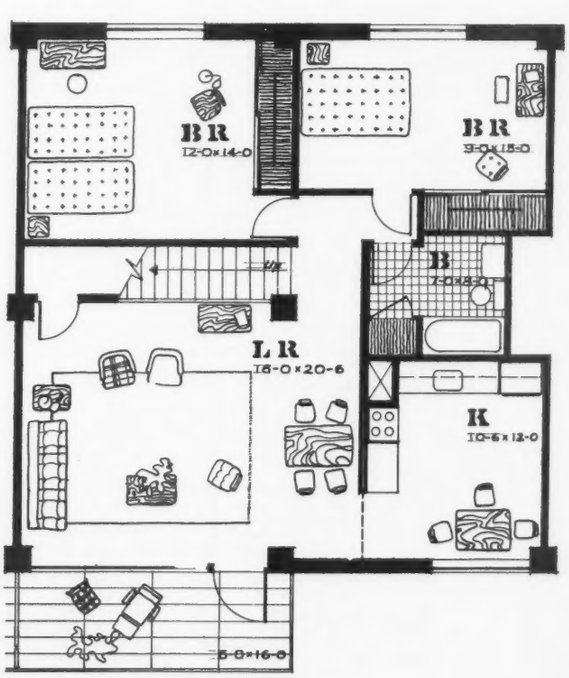
As with all buildings in the same general area, the problem of an adequate foundation is one of no small account. The ground-water level is only eight feet below the surface, and hard bottom is approximately eighty-eight feet down. At the present planning stage, subject to change based on further subsurface exploration, the decision has been to use cast-in-place concrete piles driven to the hard-pan stratum.

For the structure itself, the possibilities of steel skeleton and reinforced concrete frame were examined quite extensively. The steel frame was favored originally because of the saving in total weight and the subsequent saving in cost of the foundation. Further investigation, however, revealed advantages of the concrete frame which would justify the increased cost of the foundation.

In the first place, the concrete frame would be cheaper, though equally as strong. In addition to a saving in building height, wind bracing could be integrated within the dividing walls between the apartments. Finally, the costly anachronisms, plastered ceilings and

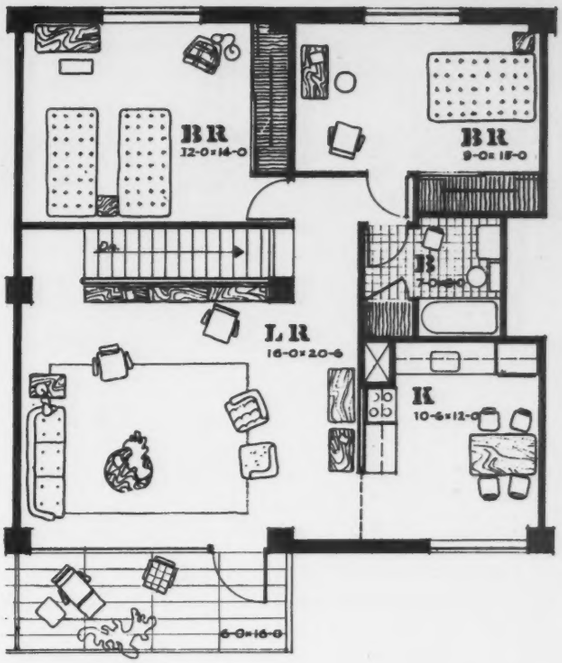
Winds

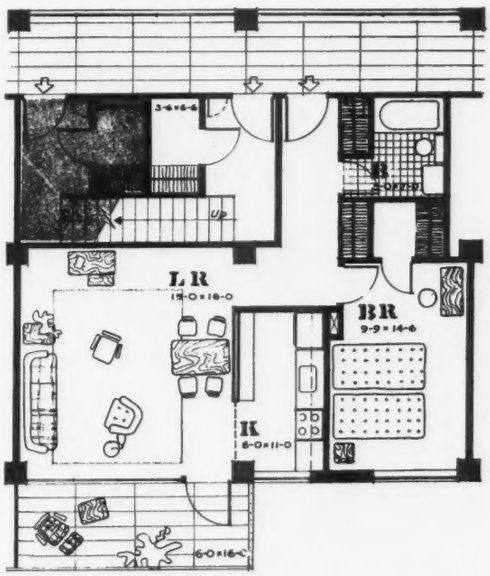




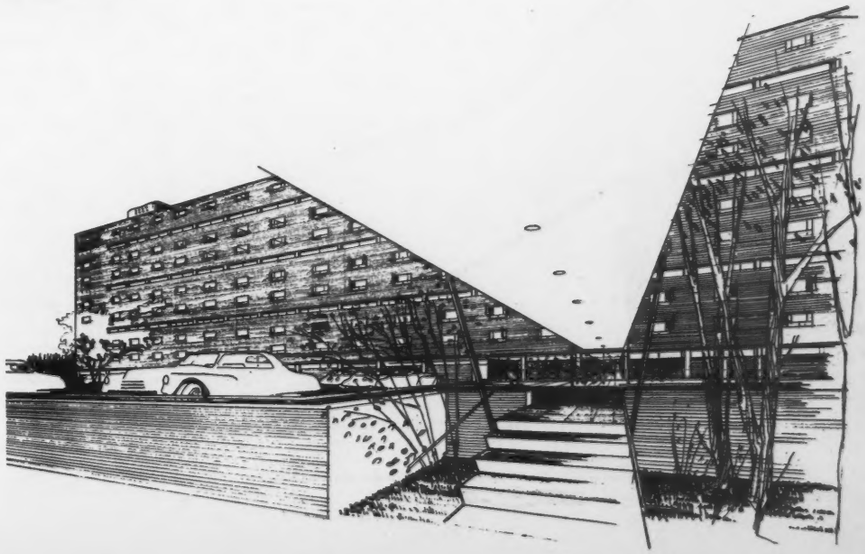
wood floors, could be completely eliminated. An attractive ceiling will be achieved by simply painting the smooth underside of the structural slab. By the same token, the living room and bedroom floors, consisting of the structural concrete slab with integral color and hardening added, will be equally attractive and practical, easy to maintain, and as suitable for rugs and carpets as any other type of flooring. Kitchen and bathroom floors will be of linoleum — the corridor floors, sound-deadening cork tile. The apartment walls will be as simply finished as the floors with a smooth integrally colored plaster which may be painted at any time.

Eastgate will introduce to the Boston area at least one radically new idea in apartment house planning. Although the building is planned for three automatic elevators, a new principle of elevator access is presented. Elevators will stop only at every third floor, which will have a corridor. The apartments on the corridor-less floors will be entered by private stairways from the elevator corridor levels as may be seen in the traffic flow diagram. This arrangement will eliminate the initial cost, subsequent maintenance cost and the noise of corridors. At the same time, the apartments on the non-corridor floors will have the advantages of a more spacious and homelike affect, much better light, through ventilation, and greater efficiency of plan.





These three typical apartment plans show the advantages of the skip-stop system of elevator access



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the dragon's den

Eastgate Ingenuity

New England Mutual, Lever Brothers, the new Hancock building, the "shell," Boston University's new campus, and of course the main buildings of Tech even now help make the Charles River Basin a "scenic" spot — that is, a place where one can really enjoy just standing and looking around. The obvious sore spot was the antiquated fair building. Its removal and the erection of what seems to be a nearly ideal apartment house is a masterly stroke.

It would seem that the Administration has shown a great deal of ingenuity in the arrangements: New England Mutual will put up all the cash and handle the sizeable administrative task of putting up in a reasonable time an apartment house that will still be thought of as ultra-modern ten years from now. Yet the M. I. T. staff will get priority in reservations. It certainly seems unlikely that there will be any space left over after the staff has been satisfied. If the present amazingly low rate of twenty-five dollars per room per month does not turn out to have been overly optimistic, probably many of the students would be glad to share an apartment.

Furthermore, M. I. T. still owns the land: it would only be leased to New England Mutual. It certainly seems to be an ideal plan. We can only hope that sky-rocketing building prices or sundry other obstacles will not force the postponement or cancellation of Eastgate.

Water in Walker

Now is the time to build an adequate drainage system in Walker Memorial. The ground nearby has already been unearthed in the process of building the new library. By the same token construction men are right at hand. There is no point in creating a state of confusion and general messiness again later on. This is the proper time — before the inertia to be overcome and the expense of doing the job grow to a prohibitive size.

Perhaps, however, the cart has been put before the horse. Innocent souls who have not had to make up a magazine in gondolas might be at a loss as to the faults of the Walker drainage system. Not so the janitors who have to sweep out the deluge in the middle of the night, all the while protecting the bowling alleys and removing any items carelessly left on the floor. The rain need not even be very heavy: the bake shop is flooded by drainage whenever too many of the Walker staff take showers upstairs at the same time.

All that needs to be done is to run a pipe — say eight inch — across to the Charles, and hook a pump to the drains so that the water will be pushed up and over into the Charles through the pipe. The rumored cost is $10,000, a figure which seems excessively high. Even at such a price, however, the denizens of Walker's Basement would think it well worth the money.

H. C. W.

When FASTENING becomes your responsibility, remember this important fact — — —

It costs more to specify, purchase, stock, inspect, requisition and *use* fasteners than it does to buy them. *True Fastener Economy* means making sure that *every* function involved in the *use* of bolts, nuts, screws, rivets and other fasteners contributes to the desired fastening result — maximum holding power at the lowest possible *total* cost for fastening.

You Get True Fastener Economy When You Cut Costs These Ways

1. Reduce assembly time with accurate, uniform fasteners
2. Make satisfied workers by making assembly work easier
3. Save receiving inspection through supplier's quality control
4. Design assemblies for fewer, stronger fasteners
5. Purchase maximum holding power per dollar of initial cost
6. Lower inventory by standardizing types and sizes of fasteners
7. Simplify purchasing by using one supplier's complete line
8. Improve your product with a quality fastener.

RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY
Plants at: Port Chester, N. Y., Coraopolis, Pa., Rock Falls, Ill., Los Angeles, Calif.

WHY GIVE WIRES AND CABLES A.C. AND D.C. TESTS?

At Okonite regular d.c. tests pick out imperfections in insulated wires and cables not detected by conventional methods. These d.c. tests, at 4 times the a.c. values, are in addition to the routine high voltage tests.

"Something extra" is typical of Okonite production techniques and research procedures. That something extra, multiplied many times spells leadership . . . reflects Okonite's engineering background as pioneers in electrical wires and cables. The Okonite Company, Passaic, New Jersey.

5131

OKONITE SINCE 1878
insulated wires and cables

waging the peace — air phase

(*Continued from page 57*)

it must then compete strongly with other models. Small personal planes have also proved relatively unprofitable.

In order to stay active and to keep their skilled workers in the field, many companies are doing work in diversified fields. Douglas unsuccessfully tried producing metal dinghies, Northrop tried the motor-scooter market, Grumman is building aluminum canoes, and one of the large Consolidated plants now makes buses and refrigerators. The real tragedy for the airplane companies and for the United States, however, is that in withering away, the aircraft industry is losing its engineers and tool and die makers in great numbers. As they are laid off, they are drifting into unrelated industries. The loss of these people to other industries is a major loss to the nation, and they should be kept available, working on aircraft planning and construction. According to an estimate made by President Gross of Lockheed, each of the major companies, for reasons of preparedness, should have a minimum of 500 to 1,000 engineers, and 400 to 600 toolmakers.

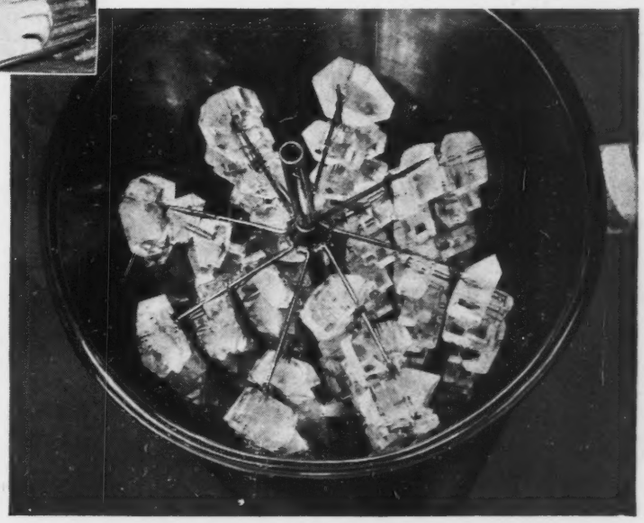
It is extremely important that many companies with high engineering skill be helped by the government, as many of these companies have been and are on the verge of collapse. One of America's famous aircraft companies, Northrop—developer of the *Flying Wing* and the *Black Widow*, has been struggling to make both ends meet, working on a few government and development contracts, its motor-scooter production,

(*Continued on page 74*)

Newsworthy Notes for Engineers

Red Light stops trouble-makers

This girl is using a test set designed by Western Electric engineers to detect defective fuses which would pass ordinary tests. X-ray studies of bad fuses showed broken fuse wire as the usual cause of failure, but that 90% of the time, the broken ends made sufficient contact to test O.K. unless the fuse was vibrated. In the new test set, the fuse is struck ten times a second with a force of 250 grams causing the broken ends to separate—an "open" for as little as ten micro seconds, lights a red light—and the fuse gets no chance to make trouble in telephone service.



Bumper crop of crystals grown from seed

Here you see a tank-full of synthetic EDT (ethylene diamine tartrate) crystals ready for harvesting at Western Electric's Electronics Shop. These have been held at a fairly constant temperature for several weeks and have swished back and forth in the solution in the tank, growing from tiny seeds into chunks the size of your fist. They will now be processed into crystal plates to filter various voice channels—nearly 500 separate conversations—traveling over the same long distance telephone circuit. Setting up equipment and working out precise controls required in growing crystals was an interesting problem for Western Electric engineers. This year's crop will produce a million or more crystal plates.

Engineering problems *are many and varied at Western Electric, where manufacturing telephone and radio apparatus for the Bell System is the primary job. Engineers of many kinds—electrical, mechanical, industrial, chemical, metallurgical—are constantly working to devise and improve machines and processes for mass production of highest quality communications equipment.*

Western Electric

A UNIT OF THE BELL SYSTEM SINCE 1882

SOON . . . THE NEW NATIONAL NC-173

The NC-173 is the wholly new product of months of post-war research, prompted by war-time advances in radio technique.

Utilizing 13 tubes in a superheterodyne circuit, the NC-173 offers an RF amplifier stage, separate AVC amplifier, voltage regulator for circuit stabilization. A wholly new concept in noise limiter design makes "double-action" noise limiting equally effective for both phone and CW.

Its tuning system offers new flexibility through tuning capacitors connected in parallel on all five bands. Its frequency range covers not only 540 to 30 MC. but also the 6-meter amateur band.

Smart styling and outstanding performance are characteristics you'll note in this newest member of the National family. At your dealer's soon.

EST. NC 1914

NATIONAL
COMPANY, INCORPORATED
MALDEN, MASS.

THE MOST DISTINCTIVE NAME IN RADIO COMMUNICATIONS

Argon "timer" on Kodak High Speed Camera puts edge marks on film, as shown below, for externally fed rectangular pulses.

Splitting a second of action into 3000 measured parts

The Kodak High Speed Camera . . . a precision instrument that gives you exact visual answers to complex industrial time-motion problems.

Milling cutter bit caught in the act of breaking. Edge marks on film give the exact relative time and speed of any phase of high speed action.

WHEN high speed machinery doesn't work as it should or wears out too soon . . . when you need to know how fast-moving liquids behave . . . when any complex time-motion problem confronts you . . . try motion analysis with the Kodak High Speed Camera.

By taking pictures up to 3000 frames a second and showing them at regular speeds . . . you visually slow down action almost 200 times! And flash marks which the camera puts along the film edge time any phase of action in fractions of milliseconds.

By using this precision instrument in your laboratory or plant, you can track down and measure almost any problem in flexure, inertia, waste-motion . . . analyze chemical and electrical phenomena for permanent record . . . for study . . . for group discussion.

Send the coupon for a copy of the booklet "Magnifying Time." It will tell you how this instrument is being used advantageously in many industries.

EASTMAN KODAK COMPANY
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High Speed Movies

. . . another important function of photography

"Kodak" is a trade-mark

Mail this coupon for new FREE booklet.

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Please send me ☐ your new, free booklet on the Kodak High Speed Camera; ☐ your 16mm. demonstration reel of examples of high speed movies.

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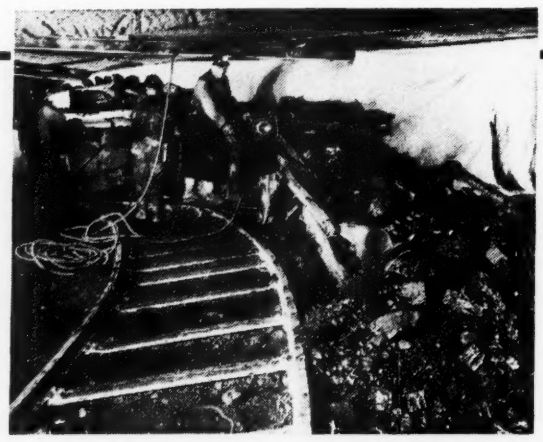
137

It's the world's largest coal mine — and it's COMPLETELY MECHANIZED!

● owned and operated by the H. C. Frick Coke Company



● The Robena Coal Mine is currently producing about 12,000 tons of coal a day. And when the mine reaches full operation, it will probably turn out 20,000 tons a day.

Robena is completely mechanized. A flick of an electric switch starts cutters, drillers, loaders, dumpers and conveyors. Workers can stand erect. A powerful blower furnishes them with fresh air. Steel beams protect them from cave-ins. An electric railway with an automatic signal system transports the coal.

Above ground, too, Robena is operated at top efficiency. Automatic blending mixes coal into a uniform grade that will be usable for steel making. At the tipple, coal is loaded into barges on the Monongahela River at the rate of a barge every six minutes.

Engineering coal mines for efficiency and safety has been a continual challenge to the operating and engineering officials of the H. C. Frick Coke Company. They have met and are still meeting this challenge.

Opportunities

The work being done for the Robena Mine typifies the spirit of the work being done in all of the subsidiaries of United States Steel Corporation.

Have you seen "Paths of Opportunity in U. S. Steel?" Ask your Placement Officer for a copy.

AMERICAN BRIDGE COMPANY · AMERICAN STEEL & WIRE COMPANY · CARNEGIE-ILLINOIS STEEL CORPORATION · COLUMBIA STEEL COMPANY
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PITTSBURGH LIMESTONE CORPORATION · PITTSBURGH STEAMSHIP COMPANY · TENNESSEE COAL, IRON & RAILROAD COMPANY
UNITED STATES STEEL EXPORT COMPANY · UNITED STATES STEEL PRODUCTS COMPANY · UNITED STATES STEEL SUPPLY COMPANY
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USS

UNITED STATES STEEL

Electron microscope, perfected at RCA Laboratories, reveals hitherto hidden facts about the structure of bacteria.

Bacteria bigger than a Terrier

Once scientists, exploring the invisible, worked relatively "blind." Few microscopes magnified more than 1500 diameters. Many bacteria, and almost all viruses, remained invisible.

Then RCA scientists opened new windows into a hidden world—with the first commercially practical electron microscope. In the laboratory this instrument has reached magnifications of 200,000 diameters and over. 100,000 is commonplace . . .

To understand such figures, picture this: A man magnified 200,000 times could lie with his head in Washington, D. C., and his feet in New York. . . . A hair similarly magnified would appear as large as the Washington Monument.

Scientists not only see bacteria, but also viruses—and have even photographed a molecule! Specialists in other fields—such as industry, mining, agriculture, forestry—have learned unsuspected truths about natural resources.

Development of the electron microscope as a practical tool of science, medicine, and industry is another example of RCA research at work. This leadership is part of all instruments bearing the names RCA, and RCA Victor.

• • •

When in Radio City, New York, be sure to see the radio, television and electronic wonders at RCA Exhibition Hall, 36 West 49th Street. Free admission. Radio Corporation of America, RCA Building, Radio City, N. Y. 20.

Continue your education with pay—at RCA

Graduate Electrical Engineers: RCA Victor—one of the world's foremost manufacturers of radio and electronic products—offers you opportunity to gain valuable, well-rounded training and experience at a good salary with opportunities for advancement. Here are only five of the many projects which offer unusual promise:

- Development and design of radio receivers (including broadcast, short wave and FM circuits, television, and phonograph combinations).
- Advanced development and design of AM and FM broadcast transmitters, R-F induction heating, mobile communications equipment, relay systems.
- Design of component parts such as coils, loudspeakers, capacitors.
- Development and design of new recording and producing methods.
- Design of receiving, power, cathode ray, gas and photo tubes.

Write today to National Recruiting Division, RCA Victor, Camden, New Jersey.

Also many opportunities for Mechanical and Chemical Engineers and Physicists.

RCA **RADIO CORPORATION of AMERICA**

Here's What NORTON Makes . . .

To Serve Many Industries in Many Fields

Abrasive Products

Grinding wheels of ALUNDUM*, CRYSTOLON* and diamond abrasives; discs and segments; bricks, sticks and hones; mounted points; abrasives for polishing, lapping, tumbling and pressure blasting; pulpstones.

Grinding and Lapping Machines

A varied line of machines for production-precision grinding and lapping and for the tool room — including special machines for crankshafts, camshafts, rolls and car wheels.

Refractories

High temperature refractories— grain, cement, bricks, plates, tile, tubes — for metal melting, heat treating and enameling; for ceramic kilns; for boiler furnaces and gas generators; for chemical processes; refractory laboratory ware; catalyst carriers; porous plates and tubes.

Norbide*

Trade-mark for Norton Boron Carbide — the hardest material made by man. Available as an abrasive for grinding and lapping; in molded products for extreme resistance to wear — especially effective for precision gage anvils and contact points; and for metallurgical use.

Norton Floors

ALUNDUM* Floor and Stair Tile, ALUNDUM* Ceramic Mosaic Tile and ALUNDUM* Aggregates to provide permanently non-slip (wet or dry) and extremely wear-resisting floor and stair surfaces.

Labeling Machines

Single and duplex automatic labeling machines for applying labels and foil to beverage bottles and food, cosmetic and drug containers.

Oilstones and Coated Abrasives

Sharpening stones and abrasive papers and cloth for every use of industry and the home craftsman. Products of the Norton Behr-Manning Division, Troy, New York.

NORTON COMPANY
WORCESTER 6, MASS.

NORTON

Trade Mark Reg. U. S. Pat. Off.

waging the peace — air phase

(*Continued from page 68*)

a turbodyne engine, and the Northrop Aeronautical Institute, which has approximately 1,100 students. Present employment in Northrop is 6,000 — about one-half of the wartime peak. Government research and development contracts at Northrop have kept 700 men busy in the engineering department, and the company actually existed for some time on experimental and development work.

For the larger companies and the aircraft industry, research, development, and experimental contracts are not enough. We have the best military planes in the world, but we have very few of a kind. Typical examples are Consolidated's XC-99, a giant transport for 300 men, and the large XB-36, a six-engined bomber. Other experimental aircraft are added to the list from time to time. However, the emphasis is on research and development only and not on production. For the well-being of the industry, a median must be reached where some emphasis is put on production. Thus, the question remains: How can the fading aircraft industry be kept strong enough to avoid disaster if war, or the threat of war, should arrive again? Some companies favor direct subsidy by the government to aircraft companies. In return for subsidies, aircraft manufacturers could specialize in any type of plane the government specifies: fighter, bomber, or transport. Standardized production, therefore, is one solution to the problem. Others do not favor specialization because they believe that government subsidies destroy competition and efficiency. Another solution is to subsidize the airlines, many of which are struggling to continue operations and serve the country.

To already heavily burdened taxpayers, subsidies for the aircraft industry seem an unbearable addition. Yet, subsidy could be considered as inexpensive peace insurance. Transports proved invaluable in the last war and were scarce to such an extent that bombers were occasionally used for transport purposes. Transports have the virtue of being useful in peacetime, as well as keeping aircraft factories in production.

The most important factor in preparedness at this date is the length of time it takes to develop

(*Continued on page 78*)

The Miracle

you put on your eggs...

Just plain Salt! But what wonders it performs in the hands of expert chemists and engineers. Its two components play a big part in the production of paper, soap, glue, metals, metal products, textiles, insecticides. They help to sanitize water, launder clothing, kill bacteria in dairies, restaurants, food plants.

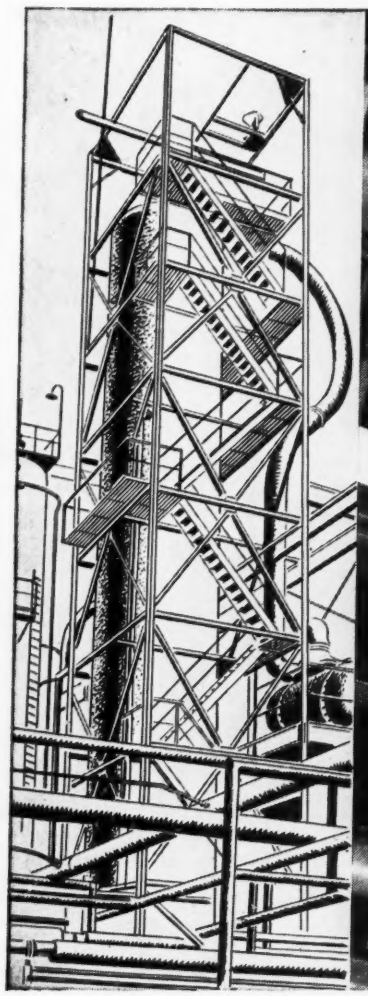
"Miracle-working" with Salt—as well as other basic chemicals—has been Pennsalt's business for 98 years. Starting with a modest plant at Natrona, Pa., Pennsalt has steadily grown, until today it stands as one of America's important chemical companies.

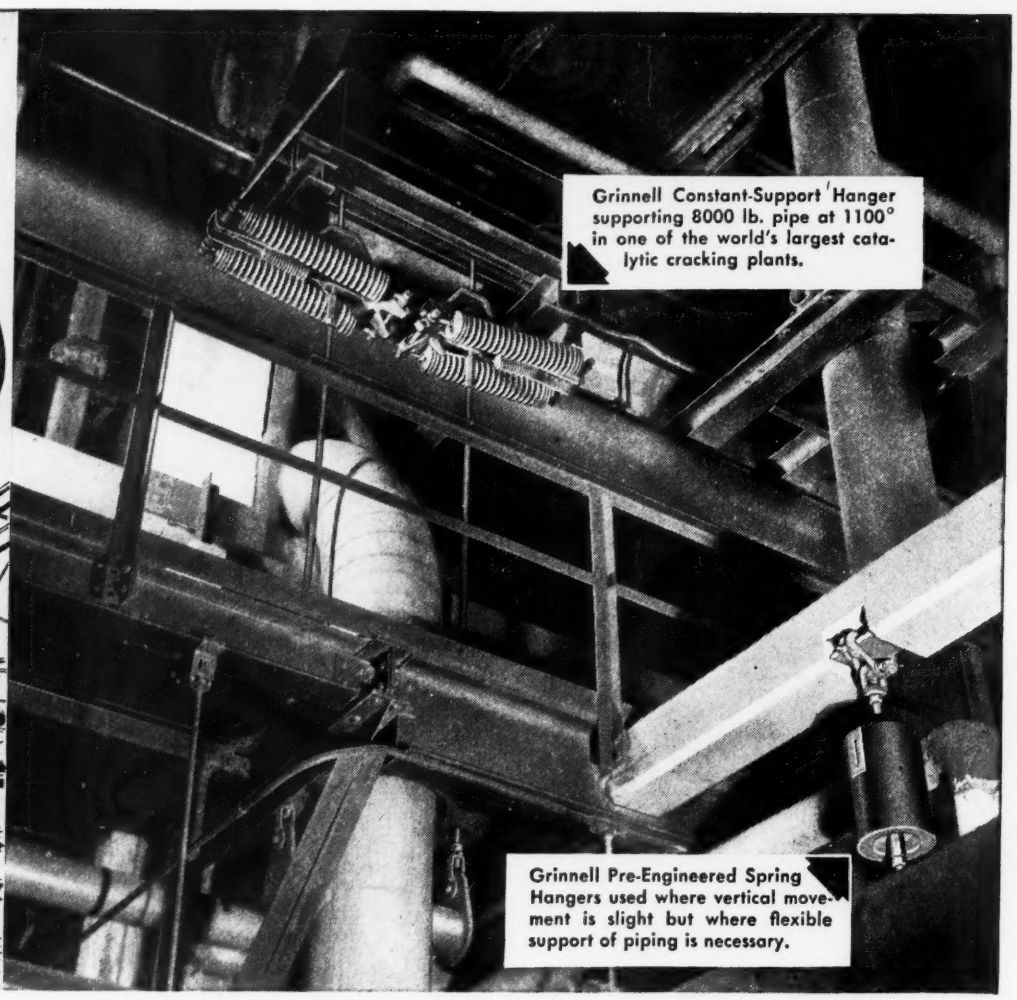
Big? Yes . . . but not so big as to swallow up its promising young men. Old? Yes . . . but not too old to adopt young ideas that are sound. Pennsalt was founded by a young man; and grew large through the efforts of young men.

The future, too, looks bright for Pennsalt . . . and for the young men who are going to build it. Pennsylvania Salt Manufacturing Company, Philadelphia 7, Pa.

PENN SALT

CHEMICALS




Grinnell Constant-Support Hanger supporting 8000 lb. pipe at 1100° in one of the world's largest catalytic cracking plants.
Grinnell Pre-Engineered Spring Hangers used where vertical movement is slight but where flexible support of piping is necessary.

When an 8,000 lb. Pipe Starts to "GROW"

. . . it takes a lot of holding

When a piece of pipe gets hot, it "grows" . . . often rising inches above its position when cold. If this expansion should be crowded back into the piping system, it would cause destructive strains, lowering the safety factor of the entire system. The pipe must be allowed to rise.

A unique type of hanger to support the pipe is needed. As the pipe rises the hangers must maintain the same lift, because the pipe weighs just as much hot as it does cold.

That hanger is the Grinnell Constant-Support Hanger, the only constant support hanger. Like a tireless arm of steel, it flexes as the pipe rises and settles, yet its lift never varies.

The solution to this complicated problem created by Thermal Movement is typical of Grinnell's complete piping service, which provides the products, the facilities and the experience to handle every piping requirement.

PIPING SUPPLIES

• Pipe, Valves and Fittings • Engineered Pipe Hangers • Grinnell-Saunders Diaphragm Valves • Thermolier Unit Heaters • Prefabricated Piping • Plumbing and Heating Specialties • Oil, Water Works and Industrial Piping Supplies.

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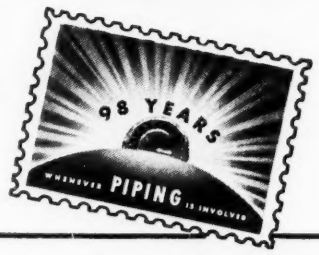


ENGINEERING GRADUATES HAVE FOUND ATTRACTIVE OPPORTUNITIES WITH GRINNELL.

HE'S MAKING THE SIGNS OF THE TIMES

HERE is a man who can put your name in lights! In sign shops throughout the country he makes the neon signs that tell you where to buy the things you need or want. The low cost and colorful eye-appeal of these versatile signs give the smallest storekeeper the same display opportunities as his biggest competitors.

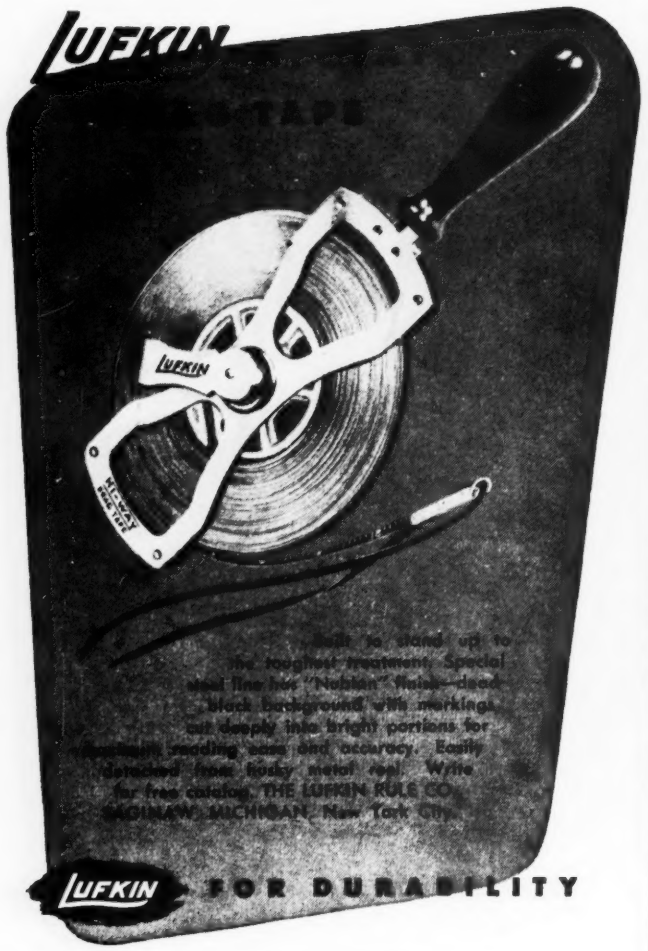
The letters that spell "drugs" or "groceries", "beer" or "ice cream", are shaped by skillful hands out of glass tubing made by Corning. The tubing is made from a special glass developed by Corning research, with many characteristics not found in ordinary glass. With the help of skilled operators, hundreds of miles of this tubing are drawn by automatic machine every day.

Out of this same research, born of nearly a hundred years of glass-making experience, has come the improved laboratory ware that helped America win world leadership in science. The gleaming Pyrex ware that bakes pies like Mother used to make, and saves dishwashing time because it can be used for serving and storing too. And now the many special tubes and other precision glass parts that are speeding television to your home.

Altogether, Corning makes over 37,000 glass products. Some day they may furnish just what you need to improve your product or make it more saleable. Remember us then. Corning Glass Works, Corning, N. Y.

IN PYREX WARE AND OTHER CONSUMER, TECHNICAL AND ELECTRICAL PRODUCTS ▸

CORNING
means
Research in Glass



can you do it?

It isn't a sphere, but —

Here is a problem which may interest those with time to spare.

Two parallel planes remain a fixed distance apart. Between the planes is a closed solid. This solid may be given any possible degree of rotation in any direction. In addition, it may be given translation in any direction within the confines of the planes. The solid always touches both planes at the same time, but yet it is not a sphere. What is it?

It is doubtful that either Sears or Phillips will aid in arriving at a solution. Remember the conditions which must be satisfied. For example, a cylinder with axis parallel to the two planes will not have complete rotational freedom. An ellipsoid can be seen to offer the same difficulty, since the planes must remain fixed, although at first glance it may seem to be a possible solution. One of the conditions obviously necessary to any solution is that the solid touch each plane at only one point when in any position.

Hint: First consider the two-dimensional case of a figure between two parallel lines.

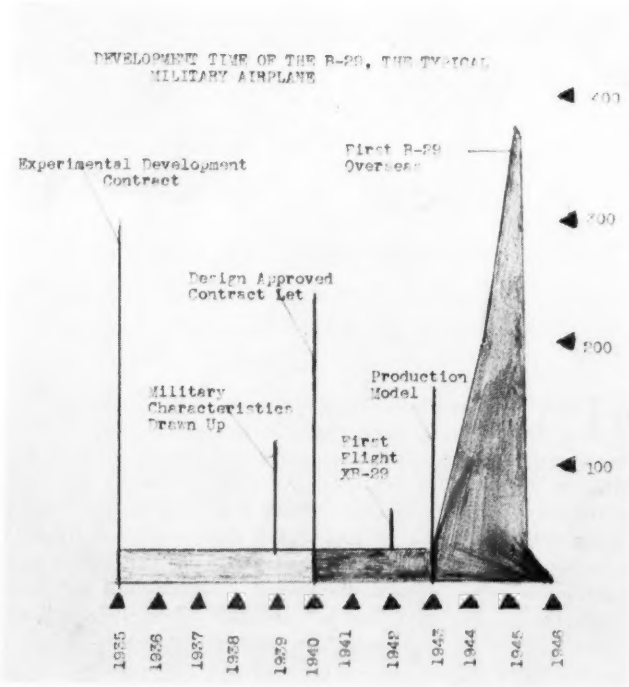
(*Answer on page 80*)

waging the peace — air phase

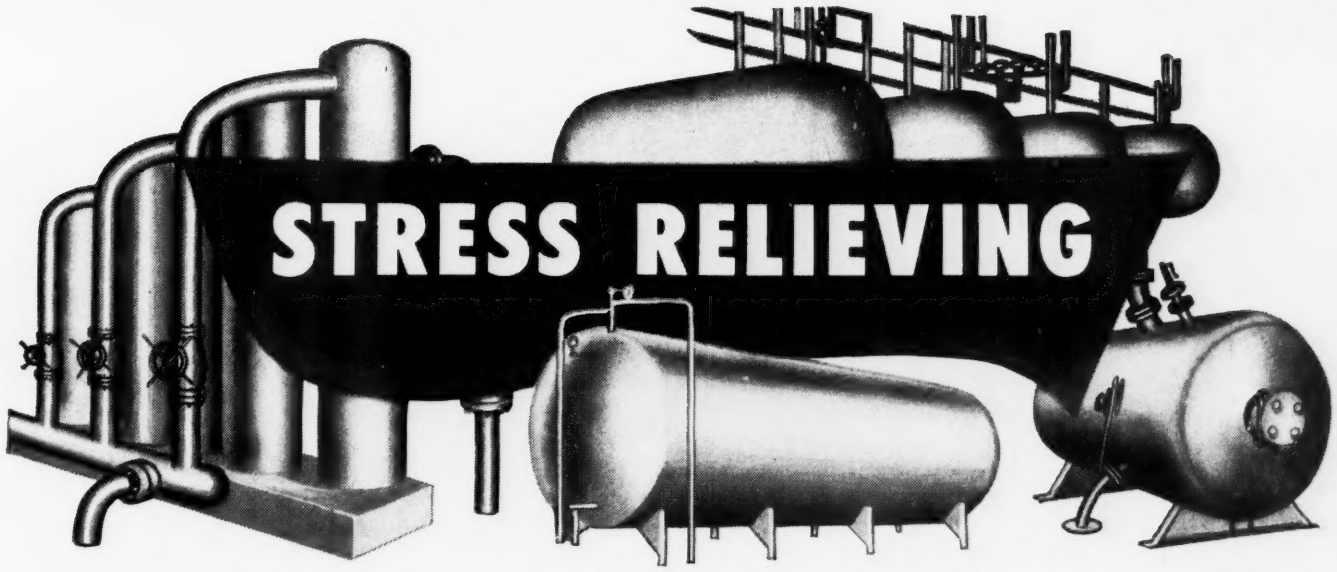
(*Continued from page 74*)

a modern aircraft and begin production. It is difficult to fully appreciate the work that goes into the planning, designing, and production of a particular plane. In 1926, it took, on the average, one-third to two-thirds of one man-year of engineering effort to develop an aircraft. Now, a four-engine plane needs 600 man-years of work. (See figure 2.) Consequently, the great fear among aviation authorities is that we will have little time, in a future war, to build up production. It is important to note that, even in the last war, all the planes we used in combat were developed, or development on them was begun, before the war began. The best example of the development of an aircraft is the case of the B-29, a plane that is familiar to everyone. The B-29, also known as the *Superfortress*, was in the development stage ten years — and the newest, up-to-date military and transport aircraft are much more complex. All in all, eleven major revisions on the B-29 were made over a period of five years.

Our obligation to keep the aircraft industry at a point where it can, in a relatively short period of time, convert completely to wartime production basis should be by now inescapably obvious. Just as obvious, though, is the fact that the minimum requirements for such a program are not being met. Six thousand planes per year is not too unreasonable a price for peace.



Development time of the B-29, the typical military airplane



Temperature Ranges Required for Pressure Vessels

at BLACK, SIVALLS & BRYSON, Inc.

Demonstrate Controllability of *GAS*

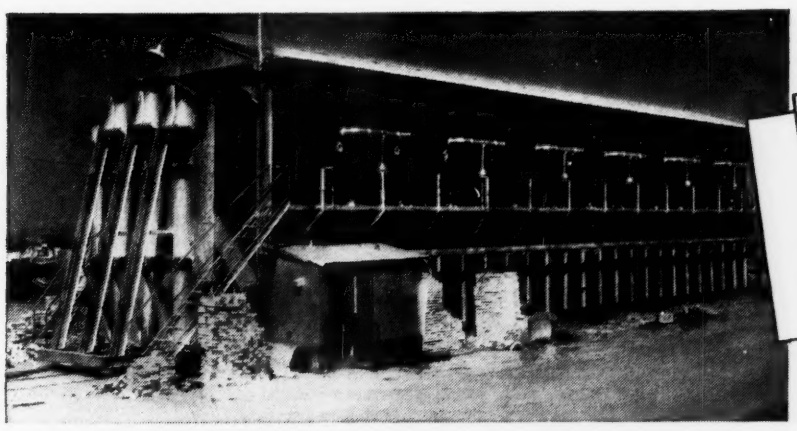
Safety codes govern many of the manufacturing and testing methods for pressure vessels. One of the most important processes, stress relieving, requires precise control of temperatures throughout the cycle—just the type of temperature control to be found in thousands of industrial applications of GAS for heat treating.

Specialists in the manufacture of pressure vessels depend on GAS for heat processing of all types. The pioneering firm of Black, Sivalls and Bryson, Inc., Kansas City, uses GAS in the manufacture of tanks, valves, pressure vessels and safety heads. President A. J. Smith says,

"Throughout the past 25 years we have depended on GAS to provide the exacting temperatures for our work. In many of our plants we have developed special GAS equipment; our large stress-relieving furnace at Oklahoma City is a typical example."

In this large furnace the GAS control system is arranged to provide temperatures up to 1200° F. for any time-cycle required. Automatic regulators and recording pyrometers assure maximum fuel efficiency while the flexibility of GAS is an important factor in maintaining production schedules on vital equipment.

Stress-relieving is just one of the applications of GAS for heat processing. You'll find hundreds of other uses for the productive flames of GAS—they're worth investigating.



MORE AND MORE...

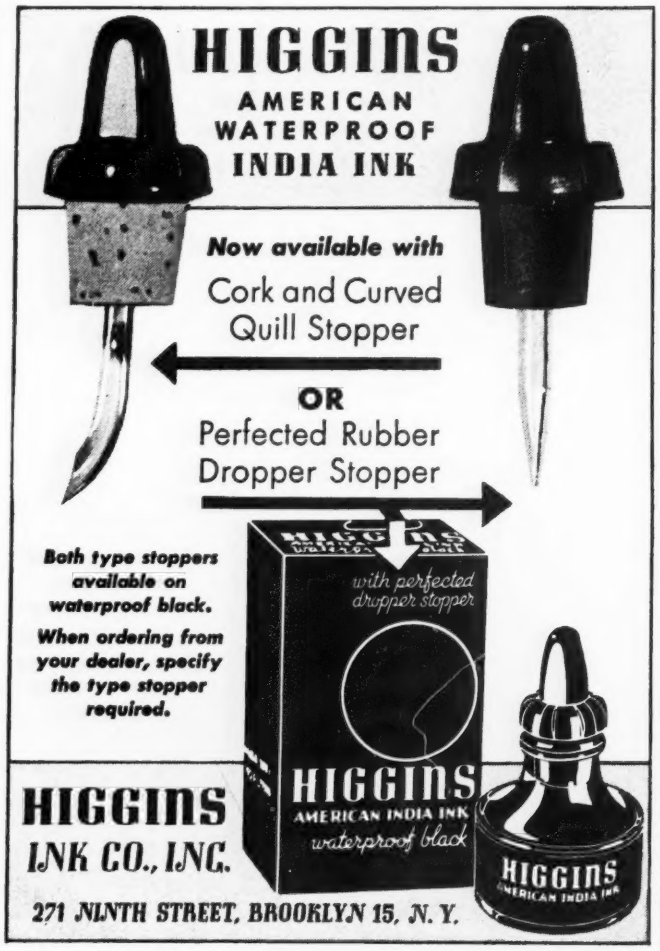
THE TREND IS TO GAS

FOR ALL INDUSTRIAL HEATING

One of the largest stress-relieving ovens in the United States, this installation at Oklahoma City is 77' long, 12' wide, 18' high—Gas-fired and equipped with recording pyrometers.

AMERICAN GAS ASSOCIATION

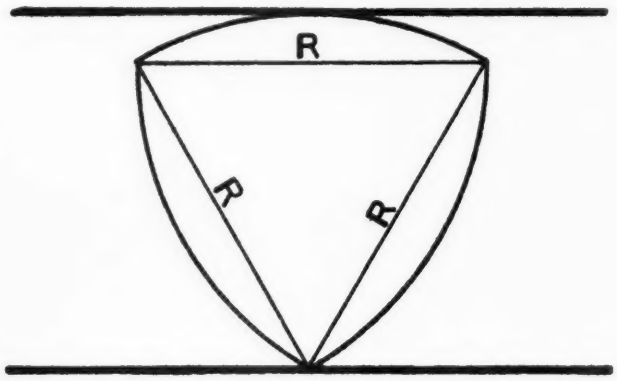
420 LEXINGTON AVENUE NEW YORK 17, N. Y.



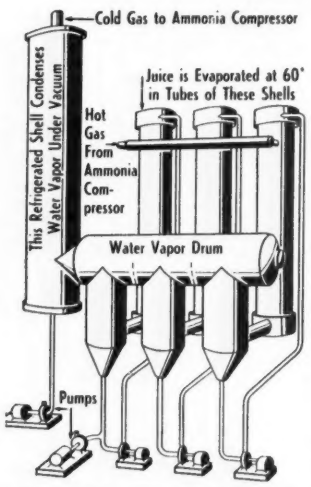
solution to can you do it?

The three-dimensional case has only one solution aside from that of the sphere. The figure is built on a regular tetrahedron having spherical surfaces on all sides of a radius equal to the length of an edge of the tetrahedron.

The two-dimensional case has an infinite number of solutions. Any regular polygon having an odd number of sides having circular arcs constructed on them whose radius is equal to the distance between the lines will satisfy the conditions of the problem.

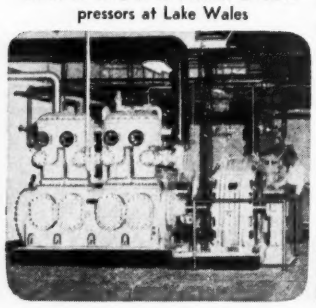


New Process Uses


Cold Gas to Ammonia Compressor
This Refrigerated Shell Condenses Water Vapor Under Vacuum
Juice is Evaporated at 60° in Tubes of These Shells
Hot Gas From Ammonia Compressor
Water Vapor Drum
Pumps

Same Refrigerating Machine Heats Juice and Condenses Water Vapor Driven Off

Three of Five Frick Ammonia Compressors at Lake Wales



FRICK Refrigeration

for both Boiling and Freezing Orange Juice!

The plant of the Florida Citrus Canners Cooperative, started in February at Lake Wales, is remarkable because it uses refrigeration instead of steam for concentrating fruit juices.

The cycle shown, on which Mojonnier Bros. Co. of Chicago have patent applications, utilizes both the heat and the cold supplied by a refrigerating machine—and with excellent economy.

A separate Frick refrigerating system quick-freezes and stores the vacuum-packed juices at ten below zero. Food values are both retained. Additional Frick machinery to enlarge the plant has recently been purchased.

The Frick Graduate Training Course in Refrigeration and Air Conditioning, operated over 30 years, Offers a Career in a Growing Industry.

FRICK CO. DEPENDABLE REFRIGERATION SINCE 1853 WAYNESBORO, PENNA. U.S.A.

coin problem

Perhaps you have racked your brains on this one before. If so, we'll bet your first twenty solutions were proved wrong. A man is given twelve pennies which are identical in size and appearance. Eleven of them are identical in weight, but the twelfth is bad — either lighter or heavier, no one knows which. In three weighings on a simple balance, with no extra weights, he must determine the bad coin.

Think it over a while and check each solution you find. Be able to account for every coin. If you can solve the problem, you will not await the solution which will appear next month in *T. E. N.*'s pages. But more than likely, you will eagerly study the complete analysis in next month's issue, in order to learn the general solution to any such coin problem.

DID WE STICK OUR NECK OUT IN 1930?

Look How Alcoa Aluminum Extrusions Have Helped Our Prophecy Come True!

On June 21, 1930, this advertisement appeared in one of America's great national magazines. "Aha!" chortled a lot of people. "Look at Alcoa sticking its neck out!"

Now, in 1948, there are many aluminum trains to ride. In the past three years alone, 450 passenger cars have been ordered in Alcoa Aluminum. 103 freight cars. 412 tank cars.

One reason for the railroads' swing to Alcoa Aluminum is typified by the big extrusion press shown above. Squeezing out intricate aluminum shapes like toothpaste from a tube, it permits big assembly savings in car structures . . . without sacrifice of strength. From the massive but lightweight beam, 80 feet long, that serves as a car side sill, down to the satiny fluted moldings around the windows, Alcoa Aluminum Extrusions find wide use.

Getting metal where it's wanted, in the most intricate of shapes, and in gleaming, lightweight, corrosion-resistant Alcoa Aluminum—these advantages have helped many an industry to production short cuts, better products.

The story of aluminum is still being written. New developments are in the making that promise as much for the future of aluminum as the promise we made about aluminum trains back in 1930. ALUMINUM COMPANY OF AMERICA, Gulf Building, Pittsburgh 19, Pennsylvania.

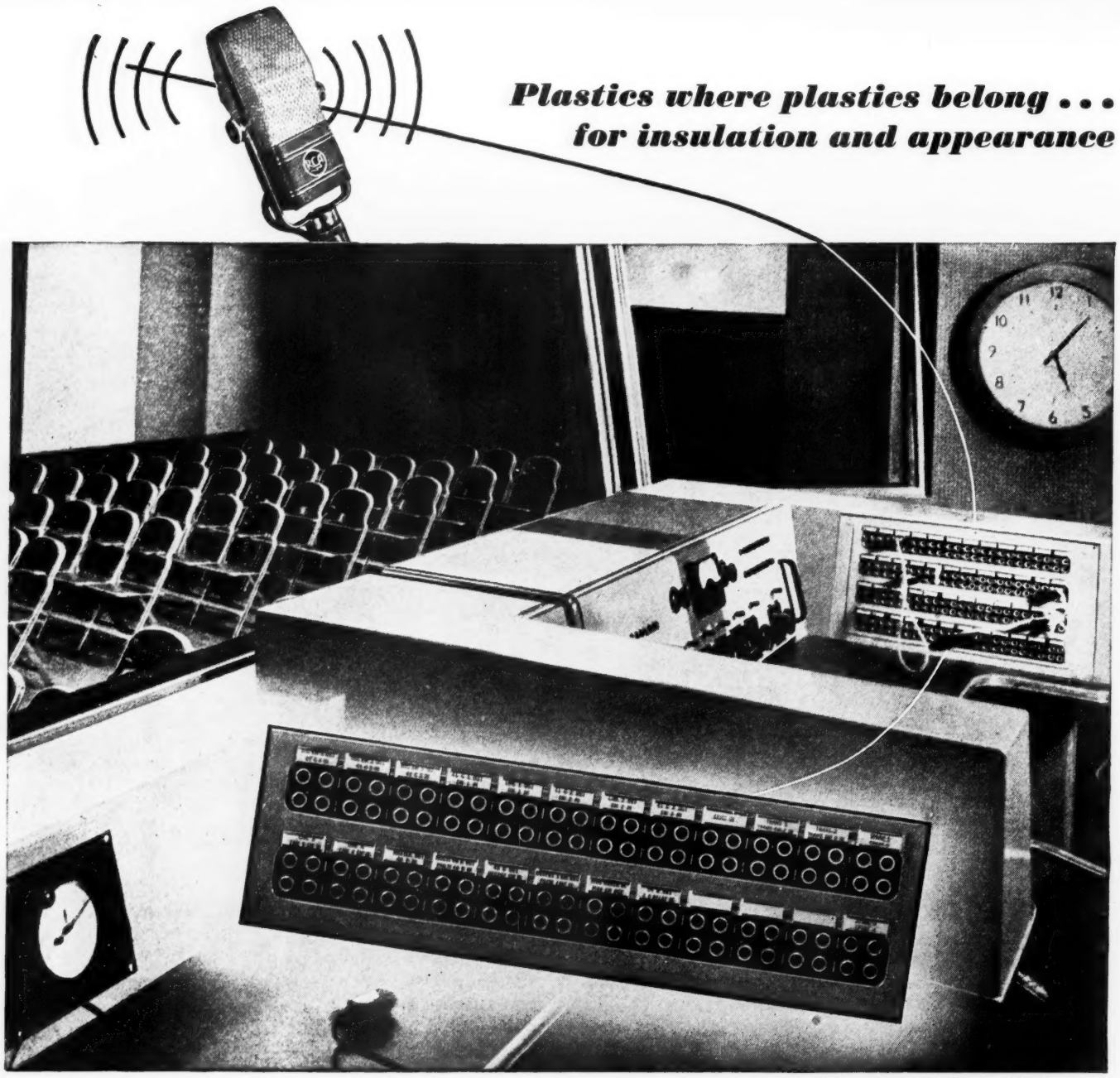
ALCOA FIRST IN ALUMINUM

ALCOA ALUMINUM 1888 1948 60 YEARS OF SERVICE

Alcoa ran the advertisement above before being able to make big aluminum beams for railroad cars—in fact, before the railroads even showed much interest in aluminum. Believing the idea was sound, Alcoa took a chance, built costly machinery to make beams, then went out and sold them. *Result:* these days you *do* ride on aluminum trains.

This is typical of the history of Alcoa. In 60 short years, Alcoa Aluminum has found its way into thousands of useful things: utensils that cook better, buildings that last longer, planes that fly faster. But this is only the beginning. New developments, now in the laboratory stage, are pointing the way to even wider uses for aluminum tomorrow.

Plastics where plastics belong . . .
for insulation and appearance



Photograph Courtesy of Station WNEW, N.Y.C.

Synthane . . . where synthane belongs

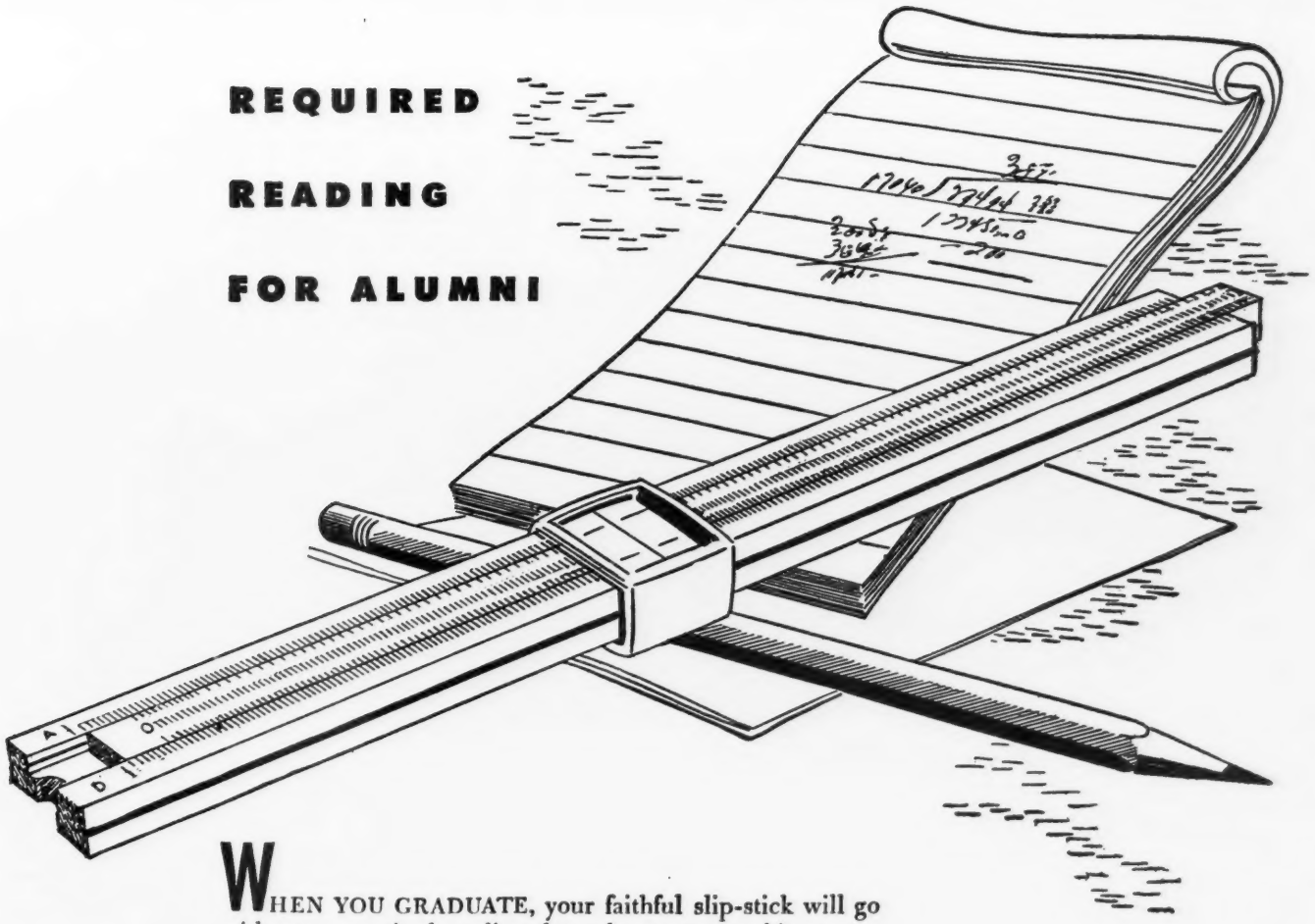
USES for Synthane laminated plastics are almost unlimited because of their combination of chemical, electrical and mechanical properties. Synthane is corrosion and moisture resistant, light in weight, quickly and easily machined. It is also hard, dense, strong, one of the best electrical insulators known. The "set" plastic, Synthane is stable over a wide range of temperatures.

An interesting example of Synthane at work is this jack panel which enables the broadcast technician to plug in or transfer amplifiers, microphones, telephone lines or other equipment, giving the input system greater operating flexibility. This is an appropriate job for our type of plastics because Synthane is an excellent electrical insulator, and contributes to the attractiveness of the control booth. Synthane Corporation, 14 River Road, Oaks, Pa.

SYNTHANE

DESIGN • MATERIALS • FABRICATION • SHEETS • RODS • TUBES • FABRICATED PARTS • MOLDED-MACERATED • MOLDED-LAMINATED

REQUIRED READING FOR ALUMNI



WHEN YOU GRADUATE, your faithful slip-stick will go with you—required reading throughout your working years. You'll take some of your textbooks with you, too, to help you go places in business. Many of these will undoubtedly bear the McGraw-Hill name—since McGraw-Hill is headquarters for technical information.

To your reference shelf of reliable McGraw-Hill books, add the McGraw-Hill magazine devoted to your particular field.

For example, if you're studying to be an electrical engineer, you probably know Terman's Radio Engineers' Handbook, Henny's Radio Engineering Handbook or Knowlton's Standard Handbook for Electrical Engineers. If you're going to be a mechanical engineer, it's very likely that you've used Marks' Mechanical Engineers' Handbook and other McGraw-Hill books in this field.

When you're launched on your engineering career, get to know *your* McGraw-Hill magazine—such as Electronics, Electrical World, Electrical Construction & Maintenance, American Machinist, or Power.

McGraw-Hill books and magazines cover practically every conceivable phase of business and industry. They'll help you do a better job.

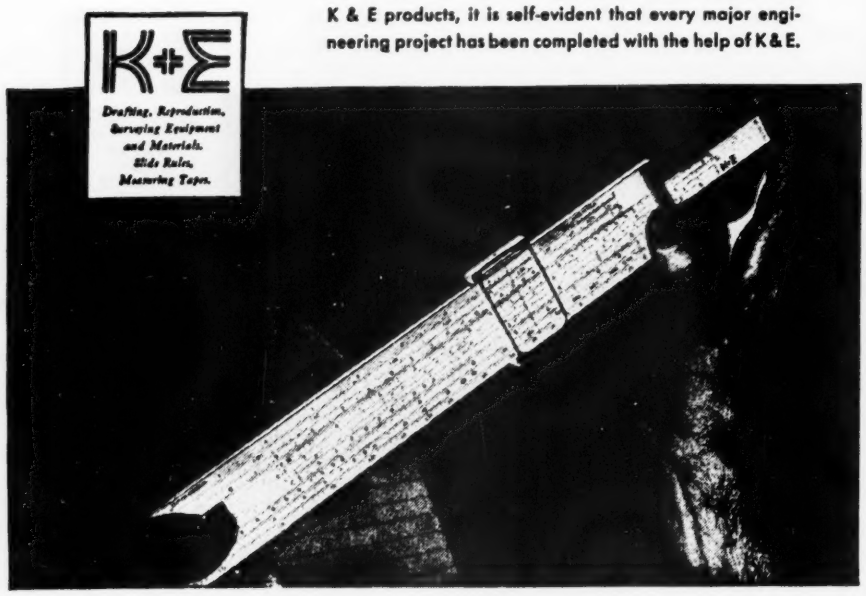
McGRAW-HILL
PUBLICATIONS

HEADQUARTERS FOR TECHNICAL INFORMATION

330 WEST 42nd STREET • NEW YORK 18, NEW YORK

partners in creating

Engineering leaders for the last 80 years have made K & E instruments, drafting equipment and materials their partners in creating the great technical achievements of America. So nearly universal is the reliance on K & E products, it is self-evident that every major engineering project has been completed with the help of K & E.

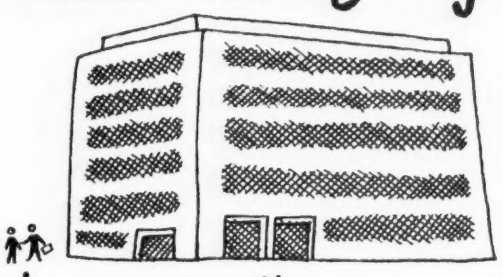


KEUFFEL & ESSER CO.

EST 1867

NEW YORK • HOBOKEN, N. J.
Chicago • St. Louis • Detroit
San Francisco • Los Angeles • Montreal

No matter how big the job-



or how small-

A National Electric Product will fit into your plans. See National Electric for a complete line of electrical roughing-in materials.

WIRES–CABLES–CONDUIT

National Electric Products Corporation
Pittsburgh 30, Pa.

double flip-flop

(*Continued from page 59*)

imperfections such as "pinholes" and dirt spots are painted out.

With the opaquing dry, the flat, as the completed layout sheet is known, proceeds to the plate-making department; here, the form is photographically transferred to the zinc or aluminum plate.

A sheet of zinc of appropriate size — some plates are as large as 44 by 66 inches — is first "grained." For proper use of lithographic plates, it is necessary that those portions of the plate which carry no image be kept moist. To facilitate this, a fine "grain" is placed on the surface of the plate by friction with fine sand and glass or wood marbles in a machine made for this purpose.

Thoroughly scrubbed with water, the plate is then coated in a "whirler" with an emulsion consisting usually of albumin and a dichromate salt. This type of emulsion, after exposure to a strong light source, becomes insoluble in water in the exposed portions.

The sensitized plate is placed in a vacuum printing frame which insures close contact between negatives and plate in order to eliminate fuzzy reproduction. Exposure of various portions of the plate may be varied by the familiar photographic process of masking.

Development of the image on the plate is handled by rubbing into the emulsion a greasy developing-ink and then washing with water. That part of the emulsion not exposed to light will come off easily, carrying the ink with it. That part exposed remains and forms a positive image once more. The plate is then cleaned, dried and given a protective etch.

In the "deep etch" process, the plate is exposed through a positive and the unexposed albumin washed off. An etching solution of dilute nitric acid and gum arabic is applied to produce a very slight depression in the unexposed portions. After etching, the hardened albumin is removed and the gum arabic remains in its place. The etched areas carry the ink and the end result is again a positive.

After use, plates can be regrained and used again.

Before placing the plate in position on the press, a greasy ink is applied for retouching weak lines and filling in solid areas. At this point work may also be removed.

Finally the plate is locked in the presses. An offset press is built around three cylinders, the first of which carries the plate. The middle cylinder is covered with a rubber blanket; and the third carries each sheet of paper. The image is transferred from the inked plate, to the rubber mat and thence to the paper. Due to the resiliency of the rubber mat, the ink is transferred evenly to the paper in spite of any irregularities in its thickness or that of the plate. The same advantage applies to an even greater extent when materials other than paper are used.

Depending on the size of the plate, which may range

(*Continued on page 88*)

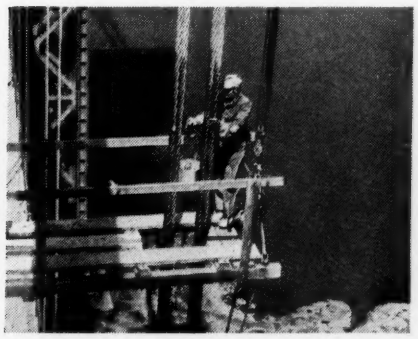
DU PONT Digest
For Students of Science and Engineering

Science paints the future

41 of every 1,000 U. S. chemists are engaged in production of paints, lacquers, varnishes and colors

Modern paint making is an outstanding example of chemistry at work—of the way the scientific approach has replaced rule-of-thumb methods.

Today, paints are formulated by chemists to meet specific needs. In their search for better finishes, these highly trained technical men are aided by the electron microscope and infrared spectroscope. A variety of gonio-



Rust would quickly weaken *this structure. Because "Dulux" resists salt water and salt air, it has for years protected many famous bridges.*

photometric and spectrophotometric devices are used by the physicist and physical chemist in the study of gloss and color.

Du Pont men have produced many superior finishes. One of them, "Dulux" nitrocellulose lacquer, made mass production of automobiles possible by shortening paint drying time from weeks to hours.

Finish failures—chipping and scratching—were costing manufacturers of home refrigerators a million dollars a year before Du Pont chemists developed "Dulux" synthetic resin enamels, based on alkyd resins. A "Dulux" coating on metal or wood dries into a film that even a hammer blow won't break. Tests with mechanical scrubbers prove it outwears old-style enamels by more than five times. "Dulux" enamels now guard boats, large and small, as well as petroleum tank farms, machinery and other industrial installations.

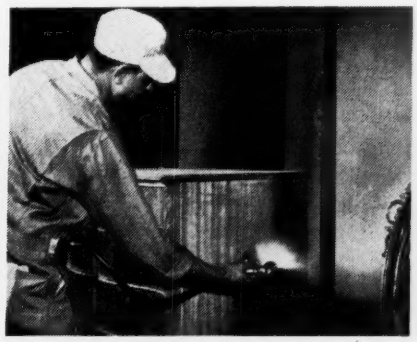
At Du Pont's paint laboratories, a wide range of materials is under study. Where the colloid chemist, the physical and organic chemist, the analyst, physicist and other technically trained men leave off, the chemical engineer, mechanical engineer and metallurgist stand ready to design equipment to make better commercial production possible.

Modern equipment speeds research

Many of today's research tools are complex and expensive. The modern research worker may use a $30,000 mass spectrometer installation which can make an analysis in three hours that formerly took three months. High pressure equipment, ultra centrifuges, molecular stills, and complete reference libraries are other tools which speed research and enlarge its scope.

Young scientists joining the Du Pont organization have at their disposal the finest equipment available. Moreover they enjoy the stimulation of working with some of the most able scientists in their fields, in groups small enough to bring about quick recognition of individual talent and capabilities. They find here the opportunity, cooperation and friendly encouragement they need. Thus they can do their best work, both for the organization and themselves.

Mark P. Morse, *B. S., Physics, Washington College '40, measures specular and diffused reflection of a sample paint surface with a goniophotometer, a Du Pont development for obtaining data on gloss and brightness.*



Satin-smooth beauty *and outstanding durability are properties given by "Duco" or "Dulux" to furniture, trucks, buses and trains.*

Paints are tested *by exposure to weather at paint "farms." Research men interpret results as guide for development of improved paints.*

Send for your free copy of this new booklet

The 40-page, fully illustrated brochure, "The Du Pont Company and the College Graduate," answers your questions about opportunities at Du Pont. Describes openings in research, production, sales and many other fields. Explains the plan of organization whereby individual ability is recognized and rewarded. Write today. Address: 2518 Nemours Building, Wilmington 98, Delaware.

DU PONT
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
. . . *THROUGH CHEMISTRY*

More facts about Du Pont—Listen to "Cavalcade of America" Monday Nights, NBC Coast to Coast

briefing the news

Salary Statistics . . .

Dr. Ruby Jo Reeves Kennedy, of the Department of Sociology of Connecticut College, has discovered that the mean salary of male morons (I. Q's of 50–60) is slightly higher than the mean salary of their "intellectual superiors."

Ultrafax, a Million Words a Minute . . .

Ultrafax, a newly developed system of television communications capable of transmitting and receiving written or printed messages and documents at the rate of a million words a minute, was demonstrated publicly for the first time by the Radio Corporation of America recently at the Library of Congress.

The Ultrafax system, RCA engineers reported, combines the elements of television with the latest techniques in radio-relaying and high-speed photography. The system is a development of RCA Laboratories in cooperation with the Eastman Kodak Company and the National Broadcasting Company.

The principal steps in transmitting and receiving by Ultrafax are:

1. Preparation of data to be transmitted, to assure a continuous flow at high speed.

2. Scanning of this data by a flying-spot television scanner at the sending terminal.

3. Transmission of the television image as ultra-high radio-frequency signals over a microwave relay system.

4. Reception on projection-type television kinescope, or "picture tube," from which incoming messages are recorded on motion picture film or, ultimately, directly onto photographic paper.

At the end of a transmission, the exposed film is passed through a miniature developing tank, rinsed and fixed in less than fifteen seconds, and dried in twenty-five seconds more.

The Ultrafax film may be enlarged to full-sized copy by means of a high-speed continuous processing machine. The equipment is similar to that used during the war for V-Mail enlarging. There is no limit to the number of Ultrafax messages which may be printed from a single film.

Among the possible developments foreseen are:

1. The exchange of international television programs achieved on a trans-oceanic basis.

2. A service of television and Ultrafax by which the same receiving set would bring various types of publications into the home without interrupting the program being viewed.

3. A system of world-wide military communications for this country, scrambled to the needs of secrecy, which with ten transmitters could carry in sixty seconds the peak load of message traffic cleared from the Pentagon Building in twenty-four hours during the height of World War II.

4. The establishment of great newspapers as national institutions, by instantaneous transmission and reception of complete editions into every home equipped with a television set.

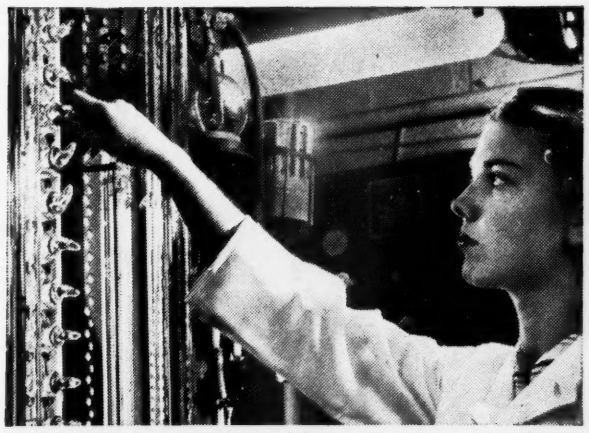
5. The transmission of a full-length motion picture from a single negative in the production studios simultaneously to the screens of thousands of motion picture theatres throughout the country.

6. The possibility of a new radio-mail system with the vast pickup and delivery services of the Post Office Department.

Something New in Spectrometers . . .

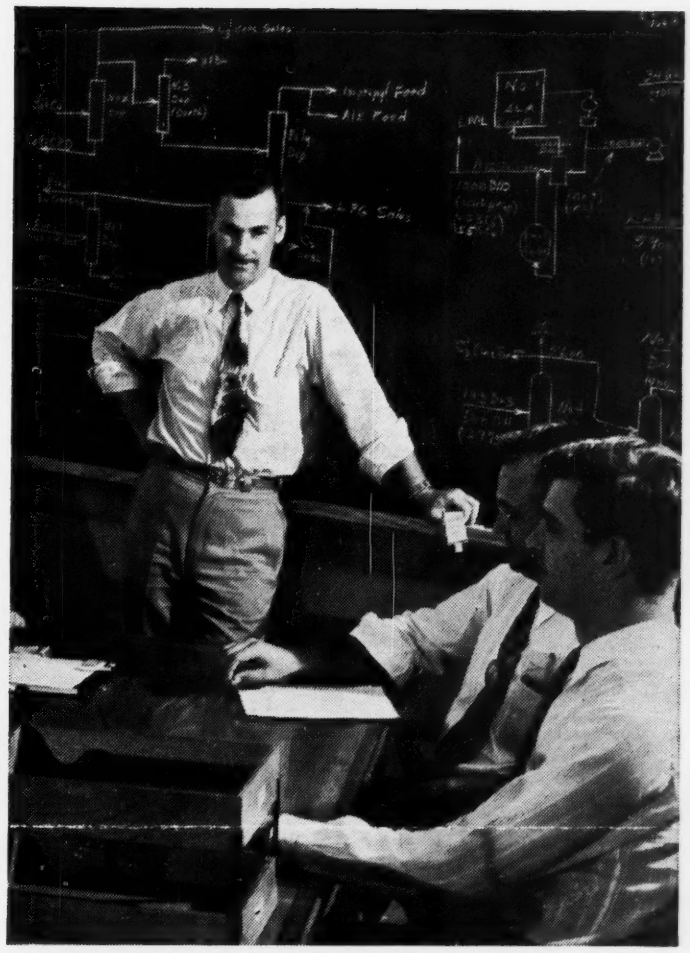
A comprehensive investigation of the conditions for the formation of negative atomic ions of the heavier metallic elements has led to the development of an extremely valuable method for detecting, separating, identifying, and measuring such ions — one of the most neglected fields of research in pure physics. In its more advanced form, this two-stage spectrometer may be used for positive ions as well as negative ions. The equipment consists essentially of a multigrid tube in which an adjustable radio frequency is applied to two grids while all other electrodes are held at the proper direct-current potentials and the ion current is measured at the plate.

Negative atomic ions have been detected for only a few elements since they were first discovered about forty years ago, although accepted theory has indicated the possibility of producing such ions from many of the elements. Experiments begun at the National Bureau of Standards in 1946 indicated that negative atomic ions might well exist in the many familiar forms of electrical discharge in vacuum tubes, but that they would not be detected if the distance through the tube between the discharge and the electrode was large. It was necessary, therefore, to devise an experimental method for separating and identifying such ions within distances of only a few centimeters. This was accomplished through the new mass spectrometer tube.



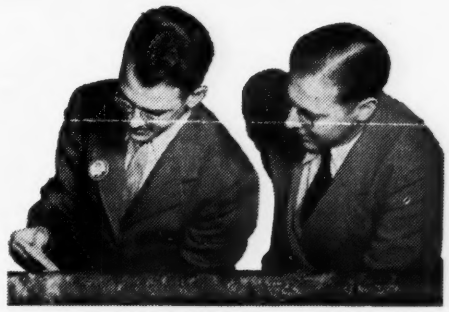
SALLY CHERRY, one of the laboratory experts who keep Esso Products high in quality.

JOHN BRITTON, Esso Heating Oil Clerk makes up delivery schedules from card index of customer needs.



W. D. BEISNER, University of Minnesota '46, **C. T. STEELE,** University of Missouri '38, **R. S. PENDEXTER,** V. P. I. '41, confer on trouble phases of refinery operation.

Good PEOPLE are Good BUSINESS!



WILBUR HUNT, Pittsburgh '42 and **D. F. EATON,** Iowa State '34 discuss Wax Plant operations.

Salesman...lab expert...office boy or president—every one of our workers knows he has a wide open chance to keep on getting ahead in the company!...

Because every president of our company has worked his way up!

Over 30 years ago, our company set out to develop, with its employees, the best possible program of benefits for its workers.

Today our workers get exceptionally good wages and exceptionally steady work. Retirement on pension at 65. Vacations with pay. Special benefits in case of accidents, sickness or death. Company training for advancement to better jobs.

Some results?...Well, no important strike or labor disturbance in over 30 years, for instance. A staff of some 28,000 workers who bring to their jobs each day an average of over 14 years' service with the company —2,000 of them over 30 years!

This means a lot in a technical, competitive business. That's why we say—good *people* are good *business!*

Copies of our booklet, "Your Technical Career," are available at the Mechanical Engineering Placement Office, Student Placement Bureau, Department of Chemical Engineering, and Department of Chemistry.

ESSO

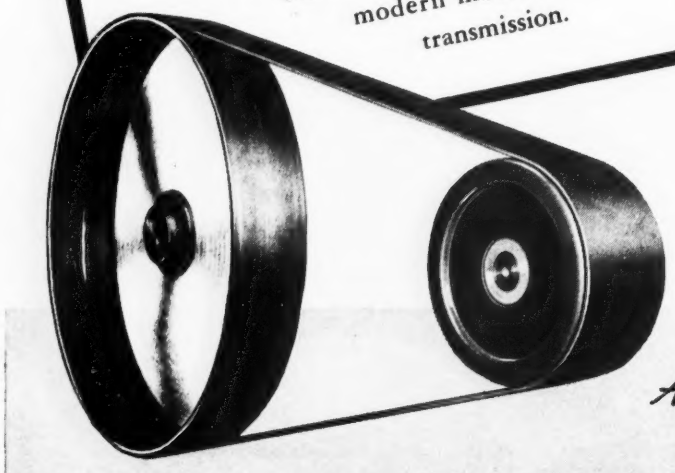
ESSO STANDARD OIL COMPANY

Leather can "take"

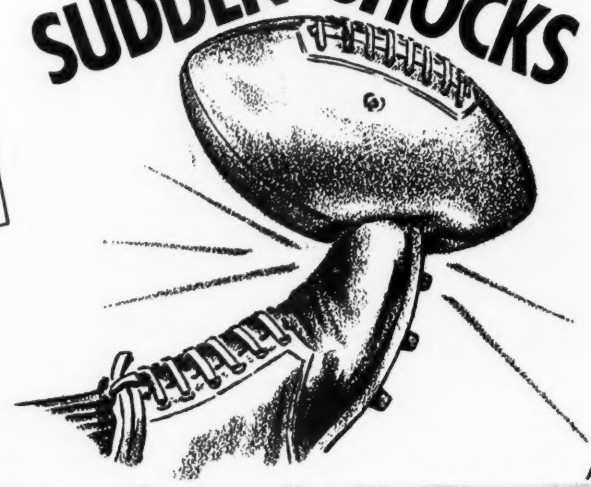
Leather has a natural, cushioning resiliency that enables it to withstand and absorb shocks.

On the gridiron, leather "takes" the fullback's punishing kick. In today's industry, leather belting absorbs power shocks between motor and driven machine.

Shock-absorbing capacity . . . that's another reason why leather belting is a modern means of power-transmission.



SUDDEN SHOCKS



AL-26

American LEATHER BELTING *Association*

Headquarters for Authentic Power Transmission Data

41 PARK ROW, NEW YORK 7, NEW YORK

DETECTS O_2 IN FEED WATER

Continuous records of the oxygen dissolved in boiler feed water and of the hydrogen entrained in steam, point to the corrective measures necessary to prevent otherwise unsuspected and costly corrosion. The Cambridge Analyzers measure and record dissolved oxygen directly. The hydrogen in the steam is the measure of the oxygen set free by dissociation. Cambridge Instruments are available for recording O_2 and H_2, either separately or simultaneously. *Send for Bulletin 148 BP.*

In addition to instruments used in power plant operation, *Cambridge* also makes pH Meters and Recorders, Galvanometers, Gas Analyzers, Fluxmeters, Exhaust Gas Testers, Surface Pyrometers and other instruments used in Science, Industry and Medicine. *Write for literature, stating application.*

CAMBRIDGE INSTRUMENT CO., INC.

3756 Grand Central Terminal, New York 17, N. Y.

Pioneer Manufacturers of

PRECISION INSTRUMENTS

double flip-flop

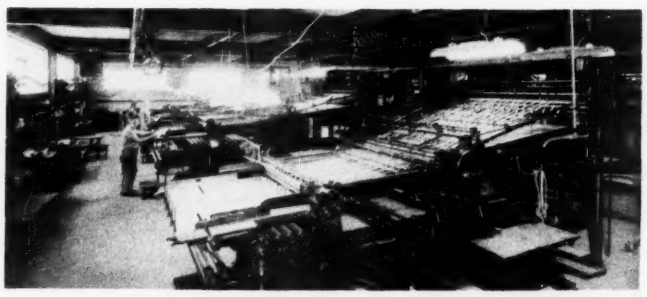
(Continued from page 84)

from 12 x 17 inches to 50 x 72 inches, rotary offset presses can turn out up to six thousand copies per hour, the smaller presses running at higher speeds. Flat bed presses previously used were limited to a speed of about six hundred per hour. Modern rotary offset presses can also print up to four colors at once.

In producing any work of size, a number of pages are reproduced by one plate, sometimes as many as thirty-two. The printed sheets produced by the presses are then cut and bound according to the specifications.

The product of the regular photo-lithographic process shows up unfavorably in comparison with the letterpress in only one important respect — that of definition in halftone images. However, "deep etch" lithography can produce definition in every respect as good as that of the best letterpress work.

Both single and multi-colored presses deliver and stack the printed material.



Thinking of improving

"Improving" any machine really means increasing its productive capacity. That means tinkering with speeds and weights and strength—ending up with alloy steels.

Which alloy steel?—the one that meets physical requirements at the lowest cost. Molybdenum steels fill that bill. Good hardenability, plus freedom from temper brittleness, plus reasonable price enable them to do it.

Send for our comprehensive 400-page book, free; "MOLYBDENUM: STEELS, IRONS, ALLOYS."

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS

Climax Molybdenum Company
500 Fifth Avenue · New York City

MOLY

C2

. . . a great name in research with a big future in CHEMISTRY

UNIQUE PLANT PRODUCES G-E SILICONES FOR INDUSTRY

On the outskirts of the little town of Waterford, N. Y. is one of the most unusual plants in the world.

New Waterford plant works night and day to produce silicones.

Where other new industrial structures may be impressive because of their physical size or tremendous productive capacity, the Waterford Works of General Electric is of interest because of the rare nature of the materials being produced there, and because of the new chemical processes involved in their manufacture.

Silicone oils are excellent mold release agents.

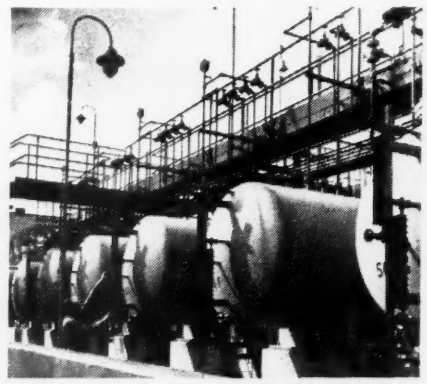
Silicones from Sand

The primary raw material from which silicones are derived is sand. This basic ingredient is modified at Waterford through a complex series of pipes, tanks, stills, and reactors which are operated in a nearly automatic production system.

The most amazing property of silicones is that, like quartz, they are relatively unaffected by heat, cold, water, chemicals, and weather. But instead of being rigid, like quartz, silicones are flexible—they may take any form from liquid to solid! This flexibility permits them to be used in many places where rigid materials with similar properties could not serve.

Silicone centers add new zip to U. S. Royal golf balls.

The finished silicone products are already being widely applied in industry, and new uses are constantly being found for them. Silicone rubber is being used for heat-resistant gaskets for aircraft and diesel engines, oven doors, and laboratory equipment. Silicone oils are excellent mold release agents for rubber and tire molders. Silicone resins promise to make possible paints and finishes of exceptional durability. Another product of G-E silicone research is called DRI-FILM*—water repellents that can be used on a variety of materials.



Tank farm stores liquid raw materials which automatic process converts to silicones.

Put Waterford on Map

You'll be hearing a lot about G-E silicones. They're really going to put that little town of Waterford on the map.

Of course, silicones are only one of the products produced by the various divisions of the General Electric Chemical Department. It also manufactures Glyptal* alkyd resins, insulating materials, permanent magnets, plastics molding compounds, and is responsible for the plastics molding operations that have made G. E. one of the world's largest plastics manufacturers. For more information, write to the Chemical Department, General Electric Company, Pittsfield, Massachusetts.

*REG. U. S. PAT. OFF.

A message to students of chemistry and chemical engineering from

J. L. McMURPHY

Manager, Chemicals Division, G-E Chemical Department

"The new world of organo-silicon chemistry is a fascinating one—and one which promises an interesting future for a young man who wants to make chemistry his career. We at General Electric are expanding our silicone research and production to meet industry's growing need for silicones."

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